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**Effect of portrait face to canvas area ratio on viewer's
perception of subject's emotions**

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Abstract. The purpose of this study was to examine the effect of portrait face size on viewer's perception of subject's emotions, which is important in many fields of human life. 73 students, including 26 men, 45 women, and 2 unknown, with the mean age 29, volunteered to participate. True experimental between-group design was used. The independent variable consisted of portraits with small, medium and big face to canvas area ratio. The dependent variable consisted of viewer's perceived strength of emotion expressed by subject on portrait. Results indicate that big faces are perceived as expressing emotions stronger. Thus, in order to convey the best possible message, or the best connection between the portrait and the audience, the size of face in portrait needs to be taken into account.

"A picture is worth a thousand words" is a well known idiom. A portrait is an exceptional example of a picture which transfers a large amount of psychological information about the subject via viewer's perception. We encounter portraits every day, from works of art to personal photographs in social media. Through a portrait, the viewer can get a glimpse of another time and place, and an artist can depict it from reality or from fantasy. In many cases, portraits are the only sources through which we can visually "encounter" the past. Beside appreciation of the art, portraits give us an idea of the psychical appearance of other people, and they also represent personality, certain emotions and the spirit of time surrounding the subject. It has been suggested (Harris, 2013; Marcus & Clarfield, 2002) that subjects on portraits by Rembrandt are depicted in a way that the expressiveness on their faces reveals what their lives have been like. This observation demonstrates the important role of portraits in psychological transferring of information, through, for example, expressions.

Despite the introduction of other media, in particularly film, portraits (although now mainly photographic instead of drawn or painted) are highly present in our daily lives. Every day, we come across portraits in mass media, social networks and through our own photographs. It is assumed that there is a meaning, in some cases an aim, behind every portrait: to convey something. Therefore, it is important, both for the disciplines of fine art, and public life (i.e., mass media and politics) to become aware of factors that play role in perception. Mastering the necessary approaches helps to convey the desired effect on viewers. This way, the best possible message, or the best connection between the portrait and the audience, can be achieved.

According to a psychological school of perception, known as Gestalt psychology, people perceive structures (which consist of parts) as whole. Whole is more than the sum of individual parts, which the whole is based on. Gestalt psychology assumes that there are a number of principles of perception (e.g., emergence). According to a different view on Gestalt psychology, functional properties of objects determine whether objects are perceived as parts, or as wholes. Generally, first the whole, and then the parts, are being perceived. The parts don't sum up to compromise the whole, but are characterized by coherence (Behrens, 1998; Wagemans et al., 2012).

With this theory in mind, understanding of perception, here particularly of portraits, needs to be refined by considering the elements of imagery which often compromise a portrait, and play role in perception of an individual image. This concept allowed me to assume that size of face on portrait (in relation to canvas size) affects the viewer's perception, which is the subject of the present study.

Portrait painting, and its psychological and perceptive aspects, are an intricate subject. There are many factors that affect how the portraits are being perceived. It seems that a substantial amount of studies on composition and perception in portrait painting regards the subject's eyes. Studies (based on art works) of composition in paintings in relation to canvas frames found common rules of composition. For example, the subject on portrait should be placed so that one of his (or her) eyes is on the vertical axis of the Golden Section level, or above it (i.e., one eye is placed vertically in the centre of canvas). Subconscious artistic judgments were proposed as an explanation to this phenomenon (Tyler, 2007). However, further studies by McManus and Thomas (2007), including an experimental study, rejected Tyler's hypothesis of the centering of one eye in portraits as being a result of an "unconscious aesthetic preference" and explained the eye-centration phenomenon as being a result of limited space on the canvas. It is known that depicting faces with direct gaze increased in the Renaissance and portraits with such gaze are preferred by current art critics (Morin, 2013). Morin (2013) proposes that favor for faces with such gaze may be explained by innate attentional bias. A subject on a portrait, that is depicted as looking straight ahead, appears to look at the viewer regardless of the viewer's location is known as the "Mona Lisa effect". While viewers clearly perceive the difference between direct and averted gaze, a big alteration of vantage point doesn't change neural activity. This can be a possible explanation to why even in decentered stimulus positions the viewer perceives the subject as looking at him (or her) (Boyarskaya, Sebastian, Bauermann, Hecht & Tuscher, 2015). In an experimental study, West and Van Veen (2007) found that Vermeer, in his painting *Girl With a Pearl Earring*, used gaze illusions that were not documented in his time: A model with the head turned to one side looking at the viewer creates an illusion of looking to the side of the viewer. Viewing model's eyes individually, they are perceived as looking outward relative to each other. Looking at the subject's eyes together, the nearer eye determines the perceived direction of subject's gaze.

The subject's mouth is another feature of expression of emotions. Study of da Vinci's portrait *La Bella Principessa* (as well as that of *Mona Lisa* (Livingstone, 2000; Soranzo & Newberry, 2015)) identified an illusion, according to which, in different levels of blur and of viewing distance, the slant of the subject's mouth is being perceived differently, which influences the subject's expression of contentment. This creates a smile which cannot be "captured" (Soranzo et al., 2015).

However, Erdos, Harvey and Tan (2001) found that viewers perceive expression of paintings not only from subject's facial expressions of emotion, but also from appearance of other details, and from the knowledge of related context such as settings in the painting, and viewer's previous knowledge of it, such as knowledge of painting's title. According to Silvia (2005), the viewer himself (or herself) affects the perception. For example, when viewing simple and complex pictures, interest depends both on complexity of the picture and viewer's coping potential. For simple pictures, ability to understand does not affect interest; for complex pictures, higher ability correlates with higher interest.

Study (Sakuta, Kanazawa & Yamaguchi, 2014) found that lighting conditions influences viewer's perception of facial expressions of subjects on portraits. Low light contrast correlates with positive emotions being perceived strongly, while high contrast with negative emotions being perceived strongly (Sakuta et al, 2014). Light source being on the left results in viewers estimating most expressions as being stronger (Sakuta et al, 2014). Variations in lightning don't affect perception regarding attractiveness or likeness (Sakuta et al, 2014). It is suggested that great portraits reflect subject's constant psychological features (i.e., personality). Further, it has been suggested that personality can be portrayed by depicted lighting on the left and the right side of face differently (Zeki's Inner vision: An exploration of art and the brain (as cited in Sakuta et al, 2014)). However, Markovic and Radonjic (2008) found that implicit features are an important factor. For example, paintings are being perceived as similar mainly on the bases of explicit features, i.e., observable characteristics such as color, shape and depth.

Regarding the role of composition, according to the study by Vartanian, Martindale, Podsiadlo, Overbay, and Borkum (2005), people who are not trained in art perceive the difference between altered and original composition; compositional balance of works of art that are considered as masterworks are not considered better than that in works considered to be of lower quality. Locher, Stappers and Overbeeke (1999) found that people who are not experts in design principle can detect the composition of a paintings with a "correct" design. However, certain previous knowledge is required to be able to distinguish between a few variations of the same compositions. The aesthetic meaning of the golden-section rectangle has been both supported and rejected by studies (Russell, 2000). Tyler (2007), in studies (based on art works) of composition in paintings in relation to canvas frames, found common rules of composition, for example: The so called compositional pyramid which is also present in portraits.

To the best of my knowledge, there is only one published article about the study that analyses portrait composition in terms of head to canvas area ratio (Bianchi, Savardi & Bertamini, 2008), which is closely, but not exactly, related to the my present study. According to their findings, there are certain tendencies in face (referred to by Bianchi et al. (2008) as "head") to canvas area ratio (presented in Figure 7 in article by Bianchi et al., 2008). Generally, the differences consist of that the face area ratio is bigger for self-portraits than for portraits of other people, and that there is a trend of increase in the depicted face size over the time period 1450-1950. Additionally, the article by Bianchi et al. (2008) also showed studies of head size estimation, according to which people estimate the size of their head as bigger than it really is, especially when there is no visual information to rely on. The results of my present study could extend and develop the work by Bianchi et al. (2008) and could clarify whether face to canvas area ratio has any effect on the viewer's perception, in particular with regard to emotion strength of portrait subject. Considering the fact that there are portraits with different face to canvas area ratios, the aim of the present study was to find out whether the area ratio can affect the viewer's perception of emotion expressed by subject on portrait. Despite the commonness of portraits, and the fact that some aspects of portraits have been studied in details, the seemingly obvious matter of the area ratio, has, to the best of my knowledge, not been studied before. The function of the frame has been studied though, and it has, for example, been suggested that its role is to unify the painting, and to separate it from the real world (Redies & Gross, 2013; Simmel, 1902/1994). In the

present study, this thought is developed by supposing that the face to canvas area ratio determines area of the face, and of the space inside a painting (i.e., the canvas), respectively. The canvas, in its turn, is defined by frames.

The aim of the present study was to find out whether variations in face to canvas area ratio in portrait lead to the expressions of emotions being perceived differently by the viewer. It was important to conduct this study to detect whether this is true because, especially if the hypothesis would be supported, this would provide artists, photographers, and other people dealing with portraits, with an empirical rule to rely on (as in the case with some other aspects of art and photography). This would help to achieve the desired result with the portrait, i.e. to convey the best possible message, or the best connection between the portrait and the audience. This empirical rule would replace choosing the area ratio apparently intuitively. There are some exceptions, of course, such as certain practical standards for photographs for documents. Additionally, the aim of the present study was to provide results which could be used as a base for psychological explanations of perception of portrait subjects' emotions.

The hypothesis of the present study was that there is a correlation between the face to canvas area ratio in portraits and viewer's perception of the subject's facial expression of emotion. The hypothesis was non directional because of insufficient previous studies. While classical portraits generally have small face to canvas area ratio (Simon, 2013), a psychological explanation presented by Bianchi et al. (2008) is that big face to canvas area ratio is related to self-serving bias. In my study, the strength of perceived emotions acts as the dependent variable since it is presumed that emotion is an important factor in viewer's perception.

Method

Participants

The data analyzed in the present study were collected using convenience sampling. The participants were students enrolled at two different psychology courses as well as at one Psychologist Program at a university in Sweden. In total 73 individuals participated; not included in the data is one individual who disagreed to have their responses used in this bachelor thesis. The participants consisted of 26 men, 45 women, and two individuals who preferred not to specify gender. Age ranged from 18 to 64. Twenty four participants stated as being "particularly interested in art". Each participant was randomized to one of three groups (questionnaires) ($n_1 = 25$, $n_2 = 23$, $n_3 = 25$, i.e. with small, medium and big faces, respectively).

Additional data were collected using both convenience and purposive sampling. Online questionnaires, in which 60 individuals participated, were published on various internet discussion forums and other websites; and provided to students at a psychology course and to private person(s) at a university in Sweden. However, subsequent analyses showed (see Discussion) that online questionnaire should not be considered to be a trustworthy measure for the present study, and data collected via it were not included in Results. (Nevertheless, online questionnaires remain a part of the present study and will be briefly mentioned wherever appropriate.)

Materials

The effects of face to canvas area ratio on perception has not, to the best of my knowledge, been considered before. Therefore, mainly novel research materials (defined below as portraits and questionnaires) were developed for the present study, although using some existing relevant materials and studies.

Portraits. For the present study, photocopies of seven realistic portrait paintings, with the subjects evidently expressing various emotions, were used. They were chosen from the set of portraits previously used by Rijks Emotions (as cited in e.g. Mollen, 2014). The selected materials were portraits by Veth (1885), Verspronck (1644), Montemezzano (ca. 1565 - 1575), Flinck (1636), van Honthorst (1623), van Anraedt (1671), Lievens (ca. 1628). The portraits used in the present study were listed above in the order they are presented in questionnaires. Below, the portraits are labeled by alphabetical letters which corresponded to the order of the portraits (i.e., first portrait defined as (a), second as (b), and so on). The portraits were considered to be an appropriate material for the present study since they are realistic, unknown to the general public (in >98 percent of cases, the portraits were unknown to participants as followed from the control question) and were classified by the abovementioned project as demonstrating one of the seven basic facial expression of emotion (e.g., anger, contempt, disgust, fear, happiness, sadness, surprise) previously described by Ekman, e.g. Ekman and Keltner (1997). I did not find any scientific support behind the Rijks Emotions project (their website is currently defunct), and instead of using their classifications of emotion types, the participants were required to choose the most appropriate type of basic facial emotion for each portrait. Analyses of emotion types was not included in the present study, and was rather used as a supplement for rating of emotion strength.

From these portraits, three sets, each containing the same seven portraits, were created. Each set was adapted to correspond to certain face to canvas area ratio. The reference point for the area ratios was based on the findings by Bianchi et al. (2008), which are showed in Figure 7 in the article by Bianchi et al. (2008). The following mode areas were identified and selected from Figure 7 (Bianchi et al., 2008): canvas area was 2500 cm², small face area was 100 cm², medium face area was 250 cm², big face area was 400 cm². The height to width ratio of the canvas of all edited portraits was chosen to be 1.2 (height) to 1 (width) (this is the aspect ratio of 61 to 51 cm, which is the British standard for head portraits). In printed questionnaires, the actual size of portraits was circa 13 to 11 cm.

The variations in the face to canvas area ratio were attained by the following way: canvas (i.e., size of the whole image) was cropped to correspond to three different area ratios in proportion to the area of the face. In each group, different amount of background was cropped. In cases where the area of canvas of the original portrait was not large enough to correspond to the desired ratio, it was enlarged using tools in the Microsoft PowerPoint program. The images were then enlarged so that the area of canvases of all portraits became, approximately, of same size. Thus, three sets of portraits, each with certain face to canvas area ratios, were created. Each set was subsequently used in corresponding questionnaire. Calculations used to create the three face to canvas area ratios used in the present study are given in Appendix 1.

Questionnaires. Corresponding questionnaires were created for each set of seven portraits: small face area, medium face area, and big face area. Apart from the differences in the face to canvas area ratios, the content in all the three questionnaires was identical. The questionnaires were in English. They were created in Google Forms. Each participant was randomized to fill in one of the three questionnaires. The content of the questionnaires is given in Appendix 2.

Procedure

The experiment used a true experimental between-group design. It used a one-way analysis of variance (ANOVA) with three independent groups with varying face to canvas area ratio to which the participants were randomized. Each set of face to canvas area ratio comprised a corresponding questionnaire, so there were three questionnaires which different only in term of face to canvas area ratio: small face area, medium face area, big face area. To achieve the required randomization, the (presorted) questionnaires were distributed approximately in the following order: small face area, then medium face area, then big face area, then small face area, and so on. The independent variable was the face to canvas area ratio, and the dependent variable was the perceived strength of emotions expressed by subject on portraits (rated on a scale from 0 = Not at all, to 10 = Very strongly). Additionally, there was a list of seven universal facial expressions of emotion to choose the dominant emotion, used as a tool for estimating emotion strength.

The questionnaires were distributed in connection to three lectures. Each lecture was given for a different class (two psychology courses and one Psychologist Program). The content of the questionnaires used in the present study was not related to any of these lectures. All sessions during which the questionnaires were distributed took place at the scheduled start of lecture, before the actual lecture began. A short presentation, in which the students were invited to participate in a questionnaire for bachelor thesis, was given. The filling in of the questionnaire was presented as being voluntary, anonymous, and about art and not anything private, and that it was estimated to take circa five to ten minutes. The fact that questionnaires contained portraits with differed face to canvas area ratios was not mentioned. The participants were not offered any compensation. None of the participants guessed the hypothesis of the study.

Results

The aim of the present study was to examine the effect of portrait face to canvas area ratio on viewer's perception of subject's emotions. Figure 1 shows mean perceived strength of emotion of all portraits with big face area. Each portrait was compared individually at the three face to canvas area rations (small, medium, big). There was a statistically significant difference between the groups for portrait (a) as determined by the one-way ANOVA: portrait (a) ($F(2, 69) = 3.171, p = .048, \eta^2 = .08$). The value which is not statistically significant, but shows an important tendency was found for portrait (g): ($F(2, 70) = 2.958, p = .058, \eta^2 = .08$). No other portrait comparisons showed statistical significance: (b) ($F(2, 70) = .877, p = .421, \eta^2 = .02$). (c) ($F(2, 70) =$

.975, $p = .382$, $\eta^2 = .03$). (d) ($F(2, 70) = 1.490$, $p = .232$, $\eta^2 = .04$). (e) ($F(2, 70) = .233$, $p = .793$, $\eta^2 = .01$). (f) ($F(2, 70) = 1.954$, $p = .149$, $\eta^2 = .05$).

The comparisons analyzed with LSD (A Least Significant Difference Post hoc test), with the significance level set at .05, showed statistically significant differences for portrait (a) between medium face area ($M = 4.6$) and big face area ($M = 5.8$, $p = .02$), see Figure 2, on the left. Although ANOVA did not show statistic significance for portrait (g), it was, nevertheless, analyzed with LSD to illustrate tendency. The comparisons analyzed with LSD, with the significance level set at .05, showed statistically significant differences for portrait (g) between small face area ($M = 3.6$) and big face area ($M = 4.9$, $p = .03$), see Figure 2, on the right.

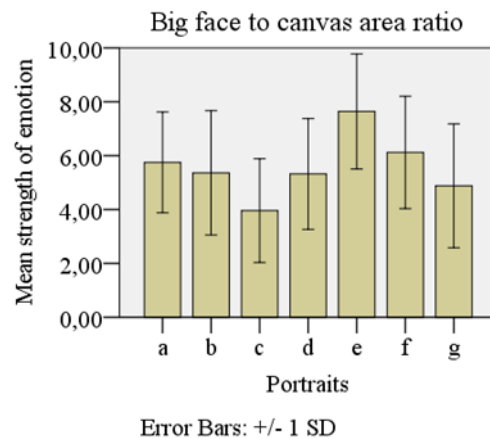


Figure 1. Mean perceived strength of emotion for all seven portraits with big face to canvas area ratio. The standard deviation (SD) is used here for descriptive error bars with the aim to show the spread of data within one ratio condition.

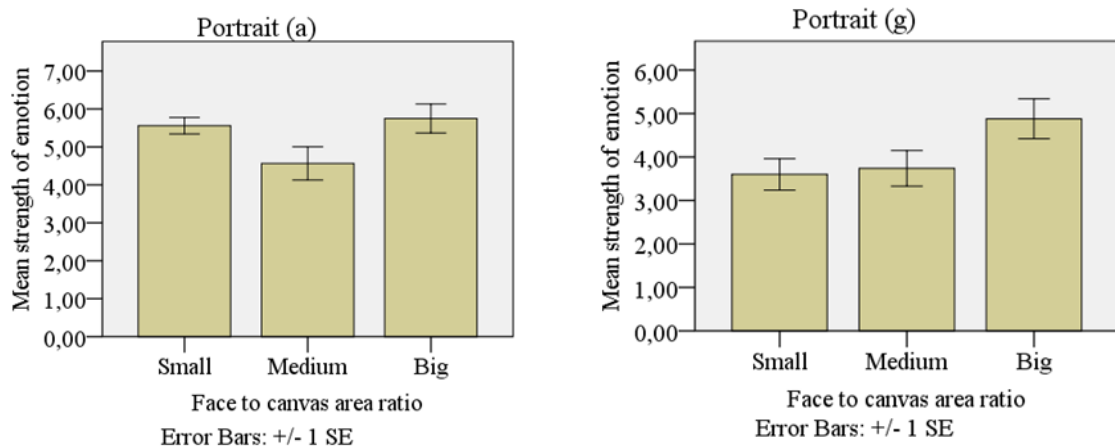


Figure 2. Mean perceived strength of emotion for portraits (a) and (g) across the three face to canvas area ratios. The standard error (SE) bars are used here with the aim to indicate ratios which are significantly different.

Discussion

The purpose of the present study was to test the hypothesis that variations in face to canvas area ratio affect the viewer's perception of the strength of emotion expressed by subject in portrait. The analysis of the effect of the different face to canvas area ratios showed statistically significant difference between medium face area and big face area for portrait (a). There was also nearly statistically significant difference between small face area and big face area for portrait (g). The fact that the difference is not between same area ratios for these two portraits might be explained by the presence of some confounding details such as hands and posture in portrait (a) in the small face area condition, while portrait (g) differs only in size of background. Possible correlation between the strength of emotion and statistical significance of variation between area ratios may explain why portrait (g) was slightly below statistic significance. Emotion displayed in portrait (g) is not perceived as strong as in (a) (see Figure 1) which showed statistical significance. In both cases, the big face to canvas area ratio is perceived to express emotions most strongly. The results for portraits (a) and (g) support the hypothesis (at least for these portraits), in particular, the notion that big faces in proportion to canvas are perceived as expressing emotions strongly than same faces of smaller size in relation to canvas. It may be possible that no statistically significant results were found for other portraits because they contain more details than portraits (a) and (g). Alternative explanations may, however, be possible too. Therefore, more studies on the subject with modified conditions (i.e. no details in portraits) are required in order to confirm the hypothesis about the effect of the face to canvas area ratio on perception. The results for portraits (a) and (g) were expected, partly because of the findings by Bianchi et al. (2008) which present certain tendencies in face to canvas area ratios, and partly because this (intuitively, for lack of previous studies) seems to be a factor no less important than the factors which showed significant results in previous studies.

The materials used in present study consisted of questionnaires with different face to canvas area ratios, which were distributed in printed version and online. Since this was, to the best of my knowledge, the first study on the subject, it relied on novel instruments and method with previously untested, and thus unknown, reliability. As the results were analyzed, the presence of some confounding variables was assumed.

As shown below, analyses led to the conclusion that portraits without details seem to be more appropriate (but not portraits with details) and printed questionnaires seem to be more appropriate (but online questionnaires are not) for the present study. Thus, the processes during which the results of the present study were obtained also helped to identify the more appropriate methods, which are an important direction for further studies on the subject. The first conclusion to this regard is that the two portraits (a and g) overall contain less details (i.e. no wine glass, music instruments, and less ornamentation, etc.) than other portraits used in the present study. Portraits (a) and (g) were also the only portraits with significant differences between groups. Thus, it is assumed that more suitable material (portraits) should contain minimum details, which is relevant at least for studies with conditions similar to distribution of printed questionnaires at lectures. The portrait should only contain the subject's face and neutral canvas background. Suitable material is a portrait with only face, or any portrait with neutral clothes (preferably the color of background) and no details. It is worth mentioning that I had this criteria in mind when choosing the material (portraits) for the

experiment, since it best matched the postulate "face and canvas", and effects of details on viewer's perception of emotions were studied previously (Erdos et al., 2001). However, since the impact of details in the conditions of my study was not confirmed, I did not prioritize this rule when choosing the material. Analysis of data led to the conclusion that details influence the perception of emotion as a confounding variable to a greater degree than was anticipated, and superiorly to other factors (i.e., face to canvas area ratio). This confirms the findings in the study by Erdos et al. (2001). The fact that the details were generally present only in some face to canvas area ratio conditions (mostly in small and medium face area) lead to simultaneous increasing of face area ratio in proportion to canvas with decreasing amount of details.

The wider implications of the aforementioned observation are that human perception should probably be considered, in lines with the view of Gestalt psychology (Behrens, 1998; Wagemans et al., 2012), and findings specifically on paintings and emotions (Erdos et al., 2001), as something that cannot evaluate one factor or object independently. The perception of expressed emotions, and probably of many other things, is guided by an interplay of various factors. This is also connected to the consideration that facial expressions, in reality, usually display a complex interplay of various types of emotions, each expressed to a various degree. The perception of emotions can be guided by the presence of various variables. This leads to the conclusion that, in case a certain desired effect in an image is sought after (i.e., happy expression), a combination of factors, supported by past and future research, may be needed (e.g., aspect ratio, details, composition, etc.) A suggested example of future research can be to add different objects to same portrait, especially objects that obviously contradict subject's facial emotion, to study how the presence of objects can affect the viewer's perception of subject's emotions.

The second conclusion from this study, in regard to the appropriate method, concerns the questionnaires distributed online (not included in Results). Unlike the printed questionnaire, the online questionnaire didn't show any statistical significance. Thus, the suitability of the online approach was considered. Having evaluated it, the fact that the portraits were being viewed through different electronic device could have violated the reliability and diminished the differences between the face area ratios. The face to canvas area ratio was distorted, or even determined, by the different size and aspect ratio of the different device screens (at least on some devices scrolling was required to view the whole portrait), its zoom level, and the assumption that participants deliberately zoomed in the subject's face. It is also possible that the canvas was simply perceived as being defined by the frames of the device screen (however, all portraits in the present study have dark canvas backgrounds). An implication from this is that all portraits, and other images, viewed through electronic devices may be defined by the frames of the device screen. It is suggested that the possibility of the effect of viewing images on electronic device screen vs. real images (such as paintings) should be studied. It is also worth mentioning, as observed by Redies et al (2013), that most photocopies of paintings that are available digitally are without frames. The portraits used in the present study were without frames as well. Although not decisive for the present study, another issue was related to sampling methods for the online questionnaire. Namely, a considerable part of online web discussion forums don't allow questionnaires which leads to certain participants/populations being excluded. This can distort study results.

Other aspects of the present study are discussed as follows. Theoretically, there was possibility of some order bias because portraits were presented in the same order in

the questionnaires. Lack of randomization was done deliberately so that not to complicate this study. Emotion types in the questionnaire lists were randomized, though. Portrait randomization may be done in future studies on the subject. As commented by some participants, the number of emotion types to choose from was limited to one of seven options (i.e., research-supported theory of universal facial expressions of emotion, for example by Ekman, et al (1997)). The options were limited deliberately, for the purposes of being able to do a manageable quantitative analysis if needed. Also, the Rijks project whose selection of portraits are used in the present study used this classification. However, it may be proposed, that in the continued studies, there will be no fixed emotions for participants to choose from, to avoid possible anchoring. The fact that portraits are mainly from the seventeenth century is not considered a shortcoming since most are by "old masters" meaning that they are of high realistic and aesthetic quality, and same portraits were presented for all groups. One of the assets of the present study is that it is most likely free from response bias, since it doesn't deal with anything private or controversial.

Having analyzed the materials and procedures used in the present study, some conclusions about an optimized approach can be made. The experiment should take place in setting and conditions approximated to the materials' (i.e., portraits') natural setting. So, the participants should view the portraits at similar conditions as during a visit to a museum. For example, by walking around with the purpose of seeing art, viewing the paintings on walls, at specific lighting, etc. The material should either consist of custom-made or copies of paintings, or large quantities of various portraits which would subsequently be grouped by face to canvas area ratio.

While this one study may not be enough to draw general conclusion about significance of face to canvas area ratio, even despite the shortcomings of the materials and the method caused by apparently high requirements for this type of study, it did give statistically significant results. They are important because they give insight into an aspect significant in many fields of human life where portraits are being used. The idea (or hypothesis) itself behind the present study has significant potential. The present study can be a source of a new field of research that can be developed and varied to create novel studies of aspects of images, context and perception. This way, many components of the "being" of images can be studied. This can provide tools to design an image that will scientifically correspond to the desired outcome.

Besides providing new directions, the present study and its results compliment previous studies on art and images, since they suggest that there is correlation between perception and context not only in terms of composition (e.g. Locher et al., 1999), frames (Redies et al., 2013; Simmel, 1902/1994), appropriate illumination (Pinto, Linhares, Carvalhal & Nascimento, 2006), etc. but also in terms of the size of portrait's canvas area in relation to the area of the face. The results of the present study are especially relevant to the findings by Bianchi et al. (2008) according to which area ratios of head (or face) in relation to area ratios of canvas increased gradually over the period 1450-1950 and was always on average bigger in self-portraits than in portraits of other people. Based on results of the present study, my assumption is that artists portray their own faces as bigger, in proportion to canvas than faces of other people, is that artists know themselves and feel their emotions better than emotions of other people (i.e. their models or subjects). Therefore, they also express their emotions better through (subconsciously) paintings a relatively bigger face. The tendency of increase of face area ratio (in proportion to canvas) can be interpreted as that portraits generally become

more emotionally expressive. So, on average, the more contemporary a portrait is, the more emotionally expressive it also is. I don't have data to rely on to provide a cause for this trend. However, it can be assumed that portraits become better on the aspect and the change is gradual since the process takes place on a subconscious level.

A possible explanation of the result of the present study, according to which the viewers perceive portraits with big face area (in relation to the area of canvas) as expressing emotions stronger, can be as follows. While it can be presumed that the answer lies within the simple notion that when a face is bigger it is also seen better with all the details of expression of emotion, one can consider that the underlying psychological mechanisms responsible for this effect are even more complicated. For example, it may be possible that when a face is being portrayed relatively big, the subject can be perceived as showing more personality and being more present, real, in focus etc. This assumption can be tested by related experiments in which the faces will be of same size in all area ratios, while the area of canvas will change.

In any case, more studies of the underlying perceptive and psychological mechanisms are needed. Besides collecting quantitative data, a suggestion is to get to the depth of the issue of psychology of image perception. This can be done through qualitative studies, such as interviews with artists and viewers. The practical applications of the findings of the present study consist in that the face to canvas area ratio can be used as a tool to study depiction and perception, and variations in it, on a level beyond estimation of fine art. For example, face to canvas area ratio in portrait (and in self-portraits) can be studied among different populations such as adults vs. children, profession artists vs. non-artists, etc. This can also be used in clinical psychological area (a related suggestion was made by Bianchi et al. (2008)). The findings of the present study, and the suggestions for further research presented here, contribute to and develop scientific psychological analyses of portraits, art and other images, and to study the significance of factors that existed since long ago but were most likely overlooked.

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Appendix 1

Calculations used to create the three different conditions of face to canvas area ratio:

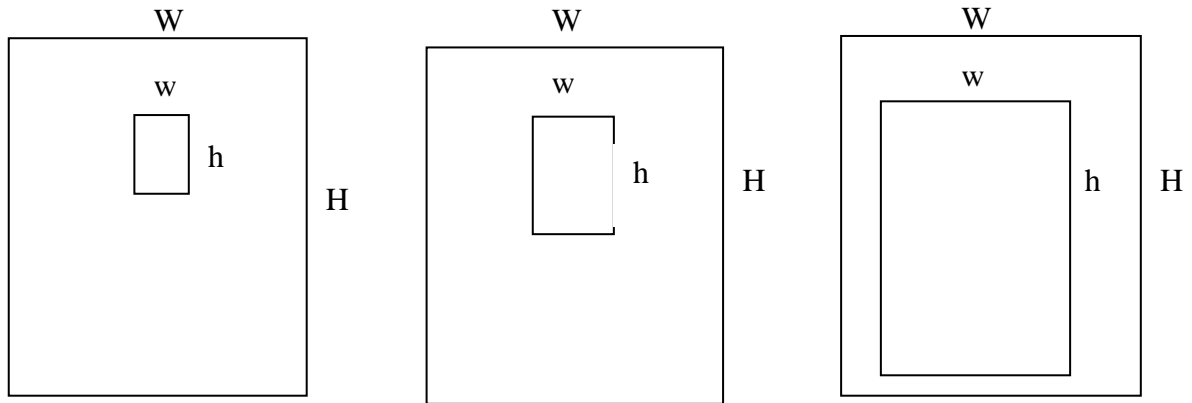


Figure 1A. W = canvas width. H = canvas height. w = face width. h = face height. From left to right: small face (1 to 25 of face to canvas area ratio), medium face (1 to 10 of face to canvas area ratio), big face (1 to 6 of face to canvas area ratio). In printed questionnaires, the size of canvas was circa 13 to 11 cm.

Calculations:

$$\frac{H}{W} = 1.2 \rightarrow H = W \times 1.2$$

$$(1) \text{ smallface: } \frac{W \times H}{w \times h} = 25$$

$$\frac{W \times W \times 1.2}{w \times h} = 25$$

$$W^2 = \frac{25}{1.2} \times w \times h$$

$$W_{\text{smallface}} = \sqrt{\frac{25}{1.2} \times w \times h} = \sqrt{20.8 \times w \times h}$$

$$(2) W_{\text{mediumface}} = \sqrt{\frac{10}{1.2} \times w \times h} = \sqrt{8.3 \times w \times h}$$

$$(3) W_{\text{bigface}} = \sqrt{\frac{10}{6} \times w \times h} = \sqrt{1.7 \times w \times h}$$

$$H = W \times 1.2$$

Then, each portrait image is enlarged with keeping its aspect ratio, so the canvases are of the same size (see **Figure 1A**).

Appendix 2

Note (not included in the questionnaires): All three questionnaires were identical apart from the face to canvas area ratio in each respective questionnaire, i.e. questionnaire one with small faces, questionnaire two with medium faces, questionnaire three with big faces.

Parts of the questionnaires marked by vertical line are repeated identically (apart from randomizing of emotions in the list) for each new portrait, i.e., seven times in each questionnaire.

Emotions in the list (1.) appear in randomized order.

Page 1

Portrait Questionnaire

Please take a look at some portraits and evaluate their emotions. The questions are about art. Your participation is anonymous and you may withdraw at any time. The questionnaire should take about 5-10 minutes.

Page 1 - 7

Image: Portrait (a) - (g)

1. Which do you think is the main emotion that the person in this portrait expresses?

Mark only one oval.

- Contempt
- Surprise
- Sadness
- Fear
- Disgust
- Anger
- Happiness

2. To what extent do you think this emotion is being expressed by the person in this portrait?

Mark only one oval

- | | | | | | | | | | | | | |
|-----|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| Not | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Very |
| at | | | | | | | | | | | | strongly |
| all | | | | | | | | | | | | |

3. Have you seen this portrait before?

Mark only one oval

- Yes
- No

Page 7

About yourself

22. What is your gender?

Mark only one oval

- Male
- Female
- Prefer not to say

Page 8

23. What is your age group?

Mark only one oval

- Under 18
- 18 - 24
- 25 - 34
- 35 - 44
- 45 - 54
- 55 - 64
- 65 or older
- Prefer not to say

24. Are you particularly interested in art?

Mark only one oval

- Yes
- No

Your comments

25. What do you think is the main idea that this questionnaire studies?

26. Would you like to add some comments?

27. Do you agree that your answers will be used anonymously in a bachelor thesis in psychology (they will not be used anywhere else)?

Mark only one oval

- Yes
- No