

# Chapter 8

## Automated Colour Identification and Quantification in Children's Drawings of God



Christelle Cocco , Zhargalma Dandarova-Robert ,  
and Pierre-Yves Brandt 

**Abstract** Colour is still a relatively neglected aspect in the study both of religious art and of children's artistic expression of the divine. Our research addresses this important gap and adds to psychological research on religious representations and conceptualization of the divine. From drawings collected in four different cultural and religious environments: Japanese (Buddhism and Shinto), Russian-Buryat (Buddhism, Shamanism), Russian-Slavic (Christian Orthodoxy) and French-speaking Swiss (Catholic and reformed Christianity) we show that children often imagine and depict god using the same colours: primarily yellow and blue. Apparently, god is often imagined by children as light or in light (yellow) and dwelling in the sky (blue). These results parallel historical and religious studies showing that the light enjoys prominent and most powerful symbolism and association with the divine. Complementary analysis of possible effect of child's age, gender, and schooling (religious or regular) did not affect the main result. This research also introduced a novel approach to data analysis by using computer vision in psychological studies of children's drawings. The automated colour identification method was developed to extract colours from scans of drawings. Despite some difficulties, this new methodology opens an interesting avenue for future research in children's drawings and visual art.

**Keywords** Colour · Children drawings · Religion · God · Cross-cultural

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C. Cocco (✉) · Z. Dandarova-Robert · P.-Y. Brandt  
Institute for Social Sciences of Religions, University of Lausanne, Lausanne, Switzerland  
e-mail: [christelle.cocco@unil.ch](mailto:christelle.cocco@unil.ch); [zhargalma.dandarova@unil.ch](mailto:zhargalma.dandarova@unil.ch); [pierre-yves.brandt@unil.ch](mailto:pierre-yves.brandt@unil.ch)

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## Colour in Religion

Colour is a prominent perceptual feature in our natural and human-made environments. It has also a special place in the visual art creating forms and rendering picture lifelike. A significant role for colour in making an image vital was evident even in early writing of Christian theologians. St. John Chrysostom (347–407), biblical interpreter and early Church Father, wrote, “As long as somebody traces the outline as in a drawing, there remains a sort of shadow; but when he paints over it brilliant tints and lays on colours then an image emerges” (as cited in James, 2003). As for symbolic and aesthetic values of particular colours, apparently, no universal rules exist. According to art historian John Gage, colours, like all formal characteristics, are ideologically neutral. Historical studies reveal that the same colours have held quite antithetical connotations in different periods and cultures, and even at the same time and in the same place (Gage, 1990). For instance, in Christianity the colour blue is often associated with heaven or the dwelling place of God<sup>1</sup> because of its direct association with the sky. In religious art of the Renaissance, blue signifies heavenly love, truth, and fidelity; it was common to depict Christ and the Virgin Mary wearing mantles of blue (Jacobs & Jacobs, 1958). At the same time, historical analysis shows that in earlier centuries, other colours were used; the Virgin was depicted wearing black or other dark colours in the eleventh century and red in the twelfth century. In the nineteenth century, after the adoption of the dogma of the Immaculate Conception, the Virgin was often shown wearing white (Pastoreau, 1990). Other factors also affected the symbolic value of various colours. The availability of dyes and pigments, their values, and their capacity for conservation largely influenced the use of colours in religious art, and consequently, influenced the symbolic value of the colours, as well (Gage 1999). For instance, the cost of lapis lazuli, which was used in production of ultramarine blue pigment, rivalled the price of gold in the Renaissance period and, when used in art, it consequently influenced the colour’s symbolic value (Gage 1999; Zuiddam, 2018). This symbolic and aesthetic complexity of colour in art and religion seems explain why colour studies in this domain are rather sporadic and most often concern the historical analysis of a particular religious object or a special colour symbolism used for a particular religious ritual.

This brief review of colours in religious art demonstrates the complexity of the question of colour in this domain. In the current project, we address this subject with regard to children’s artistic expression of the divine. Are children likely to associate particular colours with the divine? To date, there have been no studies on this topic. Thus, the present research addresses this important gap and seeks to add to the body of research on religious representations and conceptualization of the divine. Moreover, colour receives relatively little research attention in general studies of children’s drawings when compared to other aspects such as content,

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<sup>1</sup> Why the term *god* begins sometimes with an uppercase letter G, sometimes with a lowercase letter g, and why it appears sometimes in the singular and sometimes in the plural, is explained in the introductory chapter of this book (Chap. 1, this volume).

composition, and size or spatial location of drawn objects (Burkitt, 2008). This low degree of attention seems particularly surprising when we acknowledge that children consider colour to be one of the main criteria to consider when judging drawings of other children or professional artworks (Milbrath, 2008; Lin & Thomas, 2002). We expect that the present study will further contribute to this domain through the analysis of a large cross-cultural data set and new methodological approach to treat it.

## Colour in General Children's Drawings Research

To achieve a better understanding of the implications of colour in children's representation of the divine, we begin by reviewing general research on children's drawings.

Until now, most of the existing research in this domain has focussed on the expressive quality of colour and its possible association with feelings and mood states (see Burkitt, 2008, for a review of the literature). Existing research also revealed colour usage trends related to development and gender, and identified specific colour preferences of children. According these studies, young children primarily seek to create recognizable forms and figures; they use colours idiosyncratically without much regard for their realistic value (Richards & Ross, 1967; Golomb, 2004). For instance, Golomb and Farmer (1983) found that the great majority of 3-year-olds in their study used only a single colour, picked at random, for any given task (e.g., when asked to draw a family; children playing; a birthday party, or a garden with trees, flowers, and a pond). Moreover, the children used all of the colours with comparable frequency, with one exception: they rarely used the colour black. Pictures by 4-year old children become richer in colour, but children continue using colour without much concern for the representational value of any particular colour. The use of colour becomes more theme-dependent among 5-year-olds, as the principle of realism starts to guide their colour choices: the sun is depicted in yellow, grass in green, water and sky in blue. This trend toward a more naturalistic use of colour reaches near perfection in the group of 6–8-year-olds. With age, colour becomes a major determining force of the picture, and is no longer subservient to form. Older children (12–13 years old) attempt to vary the brightness value of a specific colour, for example, to suggest a distance or to unify a composition. At the same time, some older children prefer monochromatic drawings, usually drawn in pencil (Golomb, 2004).

Gender differences on the frequency of colours used in drawings were reported in some studies. Generally, research shows that girls used more colours than boys did (Richards & Ross, 1967; Tuman, 1999). Girls also blended their colours to a greater extent, and tended to use more harmonious colour combinations than boys did (Tuman, 1999). Girls generally used all colours except black, which they used only rarely (Wright & Black, 2013). In turn, boys were more likely to use contrasting colour combinations and tended to apply colour locally (Tuman, 1999). Boys' drawings were the least likely to contain pink and purple (Wright & Black, 2013);

pink was the colour least preferred by boys (Jonaskaite et al., 2019). In some studies boys chose achromatic colours more frequently than girls did (Tuman, 1999; Boyatzis & Albertini, 2000). It is important to note that such gender differences exist beyond a Western context. Alter-Muri and Vazzano (2014) invited 6–12 year old children to draw “a person in an environment”. The children were from 13 countries in Africa, Asia, Europe, North America, and Central America ( $n = 700$  drawings). Whatever the country, boys were more likely to use graphite pencil (achromatic colours) in their drawings and girls were more likely to use equal amounts of warm and cool colours in their drawings. Iijima et al. (2001) asked 5–6 year-old Japanese girls and boys to draw what came to their mind. Overall, girls used more colours per drawing than boys did, and they used pink and flesh colours in particular. Boys, by contrast, used only two colours, grey and blue, more frequently than girls did (Iijima et al., 2001).

## Colour in Children’s Drawings of Gods

As we mentioned above, colour has not yet been studied with the aim of enhancing our understanding of how children imagine and draw god. Dandarova (2013) reported a partial analysis that referenced the percentage of achromatic representations of god in her study of Buryat children in Russia ( $N = 179$ , 6–15 years old). This study showed that adolescents from the older age group (13–15) considerably more often depicted god achromatically, using only a pencil, than did two younger age groups (6–8 and 10–11).

With regard to previous studies on children’s drawings of god, researchers have focussed primarily on developmental changes as reflected in the content of pictures. This could certainly be useful to help us better understand the colour palette children use. Overall, the studies showed that children, especially when younger, produced largely an anthropomorphic or quasi-anthropomorphic drawing of god, often depicted in the sky (Harms, 1944; Hanisch, 1996; Ladd et al., 1998; Brandt et al., 2009; Dandarova, 2013). Such representations could vary from a very ordinary human figure to a quasi-human shape, sometimes including special religious or other attributes (e.g., a halo and/or light emanating from the god figure, wings, crown, etc.) (see Dessart, Chap. 3, this volume). Another large category identified by researchers represented non-anthropomorphic, symbolic representations of god. Here, children drew religious symbols and constructions, pictures of nature, the sun, a light, etc. (Harms, 1944; Hanisch, 1996; Brandt et al., 2009; Dandarova, 2013).

Taken together, this review of research shows that little has been done to study general developmental, as well as cross-cultural, patterns of colour use in children’s drawings. Moreover, no systematic research has been done on colour use in children’s pictorial representations of the divine.

## Hypotheses and Aims

The overall aim of the present study was to investigate children's colour use in drawings of gods. Of key interest was the association of some particular colours with the divine (god's representation and drawn background taken together) in different religious traditions and cultural contexts. We designed the study to explore two key questions: (1) How many colours do children use? (2) What main colours do children use when depicting god? The pioneering and exploratory nature of this study permitted us to include only one directional hypothesis concerning two main colours, yellow and blue. We hypothesized that the colours yellow and blue would be used for a larger proportion of coloured surface in the drawings from all samples. We based this prediction on two previously described colour associations. With regard to the colour yellow, bright colours, such white and yellow, are often used to depict the divine radiance and the light in religious iconographies. As for the colour blue, we anticipated that blue would often be used because of its association with the sky. Actually, existing studies of children's drawings of god show that children often imagine god's dwelling place to be in the sky (see the review in Dandarova-Robert et al. Chap. 6, this volume).

## Method

### *Drawing Task*<sup>2</sup>

Researchers provided participants with paper (size A4), a graphite drawing pencil, a set of wax pastels, and coloured pencils. The following instruction was used in all countries:

Have you ever heard the word "god"? Close your eyes and try to imagine it. Now draw it. Do not look at your classmates, because I would like to know how you imagine it.

After completing this task, the participants were asked to describe their drawings and to answer a questionnaire about their religious environment. Researchers arranged to meet with small groups of participants (10–12); participants worked individually on the drawing task. Time for drawing was not limited and the full session lasted 40 min on average.

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<sup>2</sup>For more detail about the procedure see the introduction of the present volume (Chap. 1, this volume).

## Sample

The study is based on a dataset<sup>3</sup> of 1205 children's and teenagers' drawings of god (Table 8.1) collected in three countries: Japan ( $N = 142$ ), Russia ( $N = 536$ ) and Switzerland ( $N = 527$ ). We further divided the Russian data set into two samples, Russian-Slavic ( $N = 304$ ) and Russian-Buryat ( $N = 232$ ), because of important cultural and religious differences. Orthodox Christianity is the main religion in Russian-Slavic ethnic group while Tibetan Buddhism and Shamanism are the main religions in Russian-Buryat ethnic group. Drawings were collected in two different contexts: religious schools and regular schools. In Japan, drawings were collected in Buddhist and regular schools in four prefectures: Tokyo, Kyoto, Fukushima and Chiba. All drawings in the Russian-Buryat sample were collected in regular schools because there are no religious schools in this region of Russia. For the Russian-Slavic sample, drawings were collected in Sunday schools in Orthodox churches in Saint Petersburg and in regular schools in Saint-Petersburg and Buryatia. In Switzerland, data was collected in a religious schooling context (Catholic or Protestant) or in a regular school (non-confessional) context. All drawings in the Swiss sample come from the French speaking part of Switzerland.

## Automated Colour Identification

The automated colour identification method was developed for the present research (see for more detail, Cocco et al., 2019). It analyses a scan of each drawing and associated each pixel with one of ten colours (red, orange, yellow, green, cyan, blue, purple, pink, white, and achromatic colours (grey and black)). Depending on the studied aspect (see below), a  $3 \times 3$  median filter was applied in order to reduce the amount of noise. Unfortunately, the method does not allow us to distinguish between the white colour of the paper and some parts of the drawings left uncoloured by the

**Table 8.1** Participants' socio-demographics

Sample	Number of females	Age range	Age mean	Age SD	Number of drawings in religious context
Japanese (n = 142)	60 (42.3%)	7–15	10.80	2.29	83 (58.5%)
Russian-Buryat (n = 231)	116 (50.2%)	7–16	10.98	2.70	0
Russian-Slavic (n = 302)	158 (52.3%)	6–16	10.92	2.18	102 (33.8%)
Swiss (n = 516)	269 (52.1%)	7–16	11.00	2.41	291 (56.4%)

<sup>3</sup>Some children refused to draw god or they wrote that they could not imagine it and submitted blank sheets. Consequently these blank sheets were removed from the dataset (11 from Switzerland and 3 from Russia).

children. For instance, some children did not use colours when drawing clothes and some body parts (e.g., face, arms and wings). Moreover, some other elements of decoration such as clouds were also not coloured in the majority of drawings. Consequently, we excluded white pixels for all subsequent analyses and considered only nine colours.

## *Data Analysis*

Information about the children's country/culture group, age, and gender, as well as the context of the data collection (type of schooling) were used as independent variables. To study the developmental changes, we divided the samples into three age groups: the young group with children younger than 9 years, 6 months; the middle group with children between 9 years, 6 months and 12 years, 5 months; and the old group with teenagers older than 12 years, 5 months.

We conducted three analyses in order to explore the data:

1. **Analysis of the Number of Colours in Each Drawing.** Using on the colour identification method, we determined the number of colours in each drawing using the  $3 \times 3$  median filter in order to remove noise. The number of colours ranged between one (since blank sheets were removed) and nine (since the algorithm detects ten colours and we did not include white in our analysis). We compared of the number of colours among the samples using a non-parametric Kruskal-Wallis test because the number of colours did not follow a normal distribution.
2. **Analysis of the Three Most-Used Colours in the Whole Dataset.** We analysed the colours used most frequently across the whole dataset. In order to do this, we computed the proportion of each colour in each drawing (according to the number of coloured pixels in the drawing) without applying a median filter. Then, we calculated the means of the proportions for each colour for the whole dataset. Further, based on the proportions of each colour in each drawing, the nine colours were ranked for each drawing (rank = 1 for the colour with the highest proportion and rank = 9 for the colour with the lowest proportion). Then, we computed the means of these ranks for each colour for the whole dataset. Based on these two means (colour proportion and colour ranking), we determined the three most used colours for the whole dataset on which the third part of the analyses was focused.
3. **The Most-Used Colours by Country, Gender, Age, and Type of Schooling.** We determined most frequently used colours by country, gender, age, and type of schooling. For this third part of analyses, we considered the correspondence between the main colours of the whole dataset (the three colours determined in the second part) and the main colour of each drawing as a binary relation (presence or absence). More precisely, for each of these three colours, we counted the number of drawings in which these colours were used as the main colour

(rank = 1). After that, we compared the proportions of drawings with one of these colours as the main colour, according to the independent variables. We compared the proportion of drawings with one defined colour (of the three main colours) as a main colour (rank = 1) according to the independent variables with a Chi-square test.<sup>4</sup>

## Results

### *Number of Colours Used in Drawings*

#### Country and/or Culture

We observed significant differences in the number of colours used by the children (see Table 8.2) although the median number of colours was the same and the mean number of colours was almost the same in all samples. This difference might stem from the difference between the Swiss sample and others. The Swiss children tended to use less colours in their drawings than the other children did.

#### Gender

As shown in Table 8.3, there was a significant difference between boys and girls with regard to the number of colours used the whole dataset. This tendency was confirmed when we observed the gender differences in each of the four main cultural samples: girls used significantly more colours in all samples (see Table 8.4).

**Table 8.2** Number of colours by main samples

Sample	N	Median	Interquartile range	Mean	SD	Min	Max	Kruskal-Wallis
Japanese	142	5	3	5.15	1.72	1	9	$\chi^2[3] = 14.2,$ $p = .003$
Russian-Buryat	231	5	3	5.18	2.01	1	9	
Russian-Slavic	302	5	3	5.05	2.01	1	9	
Swiss	516	5	3	4.69	1.97	1	9	

**Table 8.3** Number of colours used in drawings according to gender for the whole dataset

Gender	N	Median	Interquartile range	Mean	SD	Min	Max	Kruskal-Wallis
Girls	603	6	3	5.23	1.89	1	9	$\chi^2[1] = 29.8, p < .001$
Boys	588	5	3	4.62	2.01	1	9	

<sup>4</sup>Since three colours were tested according to each variable, a Bonferroni correction was applied to the p-values, based on three multiple tests.



**Table 8.4** Number of colours used in drawings according to gender for each sample

Sample	Gender	N	Median	Interquartile range	Mean	SD	Min	Max	Kruskal-Wallis
Japanese	Girls	60	6	3	5.53	1.63	2	8	$\chi^2[1] = 5.4,$ $p = .020$
	Boys	82	5	2	4.87	1.74	1	9	
Russian-Buryat	Girls	116	6	3	5.58	1.78	1	9	$\chi^2[1] = 7.6,$ $p = .006$
	Boys	115	5	4	4.77	2.14	1	9	
Russian-Slavic	Girls	158	6	3	5.27	1.91	1	9	$\chi^2[1] = 4.5,$ $p = .033$
	Boys	144	5	3	4.81	2.09	1	9	
Swiss	Girls	269	5	2	4.99	1.94	1	9	$\chi^2[1] = 13.7,$ $p < .001$
	Boys	247	5	3	4.36	1.95	1	9	

**Age**

There was a significant difference between the numbers of colours used by each age group, with a tendency for older children to use less colours than younger ones did (Table 8.5). We observed the same significant results inside country and/or culture samples, except in the Japanese sample (see Table 8.6).

**Type of Schooling**

We found no significant difference between drawings collected in regular schools and drawings collected in religious schools with regard to the number of colours used. This was true across all three samples that were examined for this variable (see Table 8.7). Nevertheless, across all samples, the tendency to use more colours was evident across in drawings collected in religious schools.

***The Most Used Colours in the Whole Dataset***

When computing the means of the proportions of each colour according to the number of coloured pixels in all of the samples, we find that achromatism (41.3%), yellow (19.3%) and blue (14.2%) were the most used colour choices, followed by orange (9.0%), red (8.0%), green (4.2%), cyan (3.2%), purple (0.5%) and pink (0.4%).

As a second step, we ranked the colours for the whole dataset of drawings. We present the results of this step in Table 8.8. Again, achromatic colour (shades of grey and black) was the most widely used colour with a mean rank of 1.96, directly followed by yellow (mean rank: 3.42). Then orange, blue, and red ranked, in average, between four and five. Pink and purple are clearly less common in the children’s drawings of gods.

Figures 8.1, 8.2, 8.3, and 8.4 present examples of drawings where, achromatism, yellow, orange, or blue, respectively, were used most often, (i.e. the rank was equal

**Table 8.5** Number of colours according to age groups for the whole dataset

Age groups	N	Median	Interquartile range	Mean	SD	Min	Max	Kruskal-Wallis
Young	396	6	3	5.39	1.80	1	9	$\chi^2[2] = 31.7, p < .001$
Middle	391	5	2	4.84	1.92	1	9	
Old	404	5	3	4.57	2.09	1	9	

**Table 8.6** Number of colours according to age groups for each sample

Sample	Age groups	N	Median	Interquartile range	Mean	SD	Min	Max	Kruskal-Wallis
Japanese	Young	49	5	2	5.12	1.68	1	9	$\chi^2[2] = 0.1, p = .934$
	Middle	50	5	3	5.20	1.75	1	9	
	Old	43	5	3	5.12	1.78	2	8	
Russian-Buryat	Young	81	6	2	5.81	1.59	3	9	$\chi^2[2] = 11.2, p = .004$
	Middle	67	6	3	5.15	1.88	1	8	
	Old	83	5	3	4.58	2.28	1	9	
Russian-Slavic	Young	95	6	2	5.84	1.56	1	9	$\chi^2[2] = 18.9, p < .001$
	Middle	112	5	3	4.88	1.94	1	8	
	Old	95	4	4	4.47	2.25	1	9	
Swiss	Young	171	5	2	5.01	1.96	1	8	$\chi^2[2] = 8.9, p = .012$
	Middle	162	5	3	4.57	1.94	1	9	
	Old	183	5	3	4.48	1.98	1	8	

to one for the selected colour). As we can see in these examples, achromatism, yellow, and blue were identified by the algorithm just as we would expect them to be; to the eye, the yellow looks yellow and the blue looks blue. The shades identified by the algorithm as orange, however, were not necessarily those that humans would identify as orange (Fig. 8.3). In fact, the algorithm also includes brown (for instance to depict a beard or the cross) in the orange category. It does this (correctly) because brown actually is a shade of orange; but this does not correspond to our human expectation. Taking these limitations into consideration, we treated only three main colours, namely, achromatism, yellow, and blue, in further analysis.

## *The Most Used Colours by Country, Gender, Age, and Type of Schooling*

### **Country and/or Culture**

As detailed in Table 8.9, there is a significant difference between samples with regard to the use of achromatism (grey and black) as the main colour ( $\chi^2[3] = 30.5, p < .001$ ). In descending order, there were 55.2% of such drawings in the Swiss sample, and 53.5% in the Japanese sample. In the two Russian samples their number was less: 39.1% in the Russian-Slavic sample and 38.5% in the Russian-Buryat sample.

**Table 8.7** Number of colours according to the schooling context for each sample

Sample	Context	N	Median	Interquartile range	Mean	SD	Min	Max	Kruskal-Wallis
Japanese	Regular	59	5	2	5.07	1.59	2	8	$\chi^2[1] = 0.2,$ $p = .618$
	Religious	83	5	3	5.20	1.82	1	9	
Russian-Buryat	Regular	–	–	–	–	–	–	–	–
	Religious	–	–	–	–	–	–	–	
Russian-Slavic	Regular	200	5	3	4.95	1.95	1	9	$\chi^2[1] = 2.2,$ $p = 0.134$
	Religious	102	6	3	5.25	2.12	1	9	
Swiss	Regular	225	5	3	4.48	2.06	1	9	$\chi^2[1] = 3.5,$ $p = .061$
	Religious	291	5	2	4.85	1.89	1	9	

**Table 8.8** Means of colour ranking for all drawings, ordered from 1 (*most used*) to 9 (*least used*)

	Achromatism	Yellow	Orange	Blue	Red	Green	Cyan	Pink	Purple
Mean	1.96	3.42	4.08	4.53	4.59	5.37	6.06	7.44	7.55
SD	1.20	1.94	1.69	2.40	1.90	1.77	1.84	1.27	1.27

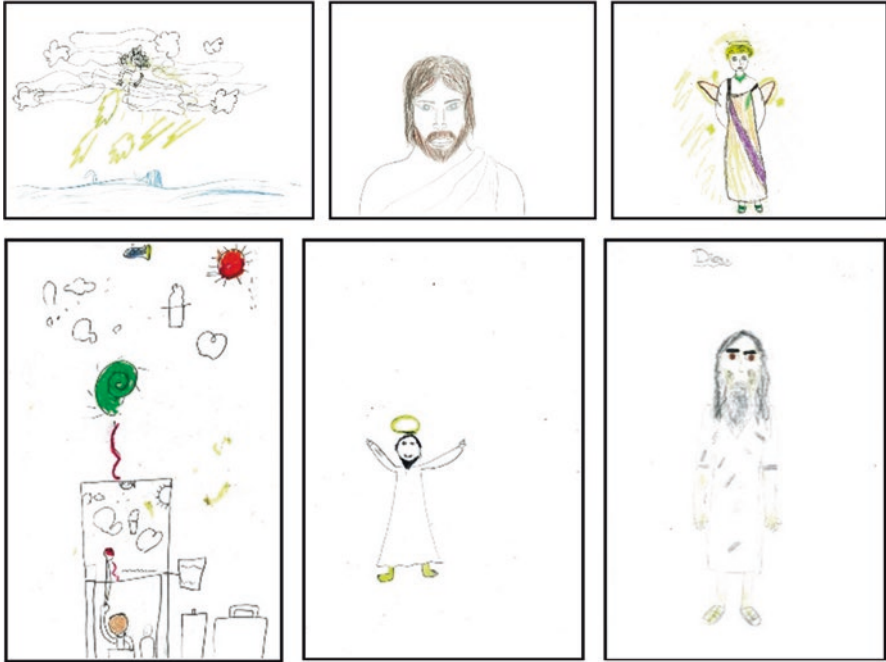
For drawings where yellow was the prominent colour, the difference between samples was also statistically significant ( $\chi^2[3] = 14.9, p = .006$ ): 25.8% of the Russian-Slavic children used yellow as the prominent colour in their drawings; followed by 22.9% of the Russian-Buryat children, 19.0% of the Japanese children and 15.3% of the Swiss children.

Finally, for drawings where blue was the prominent colour, the difference between the samples was not significant ( $\chi^2[3] = 13.1, p = .013$ ).

### Gender

When considering the whole dataset (Table 8.10), we observed a significant difference between girls and boys for achromatic prominence ( $\chi^2[1] = 21.6, p < .001$ ) and blue prominence ( $\chi^2[1] = 6.9, p = .026$ ) but not for yellow prominence ( $\chi^2[1] = 14.9, p = .284$ ).

When we look into the details of gender by country and/or culture sample (Table 8.11), we observed a statistically significant difference only in Swiss sample for achromatism, although boys in all cultural groups elected to use an achromatic colour scheme in their drawings than girls did. The same result was found for the use of blue colour: only the Swiss sample demonstrated, statistically, that more girls (in proportion) used this colour than boys did. Thus, the difference found for achromatism and blue was due primarily to the Swiss sample. As for yellow, there was no significant difference between boys and girls in each of samples. This result is consistent with that found in the full dataset (Table 8.10).



**Fig. 8.1** Six drawings randomly selected from those showing achromatism as the most used colour (first colour) ([http://ark.dasch.swiss/ark:/72163/1/0105/1C9498fITMacuoPz8s\\_GkQH.20180702T195844365Z](http://ark.dasch.swiss/ark:/72163/1/0105/1C9498fITMacuoPz8s_GkQH.20180702T195844365Z), <http://ark.dasch.swiss/ark:/72163/1/0105/9WNXqqOORsC0iKaJ9wFmFAc.20180702T193121815Z>, <http://ark.dasch.swiss/ark:/72163/1/0105/Gy9MGxK0RD OcQd=23eDs=Ae.20180702T191824085Z>, <http://ark.dasch.swiss/ark:/72163/1/0105/a1IJM5iST MyU=HSdZr3CDAq.20200325T144023936086Z>, [http://ark.dasch.swiss/ark:/72163/1/0105/ua3RlhCDR\\_GJATuEJTjimQH.20180702T160731797Z](http://ark.dasch.swiss/ark:/72163/1/0105/ua3RlhCDR_GJATuEJTjimQH.20180702T160731797Z), [http://ark.dasch.swiss/ark:/72163/1/0105/l6S=JjYiT2Gews\\_4zYWPPwU.20201108T084925701198Z](http://ark.dasch.swiss/ark:/72163/1/0105/l6S=JjYiT2Gews_4zYWPPwU.20201108T084925701198Z))

## Age

Regarding age, impact results are significantly different for all three colours across the whole dataset (Table 8.12). The proportion of children using mainly achromatism or yellow as the first colour increases with age, at the same time the proportion of children using mainly blue decreases with age.

When looking within each sample (Table 8.13) we observed significant differences for achromatic colour only in the Russian-Buryat sample. The Russian-Slavic and Swiss samples displayed the tendency to use more achromatism as age increased. This runs contrary to findings in the Japanese sample. Regarding yellow as the main colour choice, we observed this trend across all of the samples: but the trend is supported specifically in the Japanese, Russian-Buryat, and Russian-Slavic samples (not in the Swiss sample). However, the proportions are not significantly different. Finally, as participant age increases, we observe a decrease in the proportions of children using mainly blue in their drawings across all samples with the exception of the Japanese sample. Again, across all samples, the proportions are not significantly different.



**Fig. 8.2** Six drawings randomly selected from those showing yellow as the most used colour (first colour) (<http://ark.dasch.swiss/ark:/72163/1/0105/Gb3VP=5zS=2X=6CdtJeMLQn.20180702T163908277Z>, <http://ark.dasch.swiss/ark:/72163/1/0105/wUT9e0NbTeiUErJOTE2MEQp.20200415T114805688233Z>, [http://ark.dasch.swiss/ark:/72163/1/0105/duba83\\_9RFWEs1bTbJgvGAs.20180702T192115319Z](http://ark.dasch.swiss/ark:/72163/1/0105/duba83_9RFWEs1bTbJgvGAs.20180702T192115319Z), <http://ark.dasch.swiss/ark:/72163/1/0105/faW3u0jpR6qXKYmgf0ae2Aq.20180702T193537348Z>, <http://ark.dasch.swiss/ark:/72163/1/0105/AEJs5pXURRmIAOaNzfhIrAZ.20180702T184940719Z>, <http://ark.dasch.swiss/ark:/72163/1/0105/wqqNxLCETW6GT0GNfHSHawq.20180702T155913317Z>)

**Type of Schooling**

As for the relation between the drawn background and religious or regular schooling context, we examined the data from three samples. In these three samples (Japanese, Russian-Slavic, and Swiss), drawings were collected in two distinct settings: (1) in the context of religious schooling, and (2) in the context of regular (not religious) schooling. (As noted previously, all of the drawings from the Russian-Buryat sample were collected in regular schools, so we did not analyse the drawings from this sample for the impact this variable). For the three main colours that we examined, we found no significant difference between drawings collected in religious schooling context and those collected in a regular school context (Table 8.14). While the results did not qualify as significant, they did indicate that the achromatic colour scheme was used less often as the main choice of colouration in the religious context (for all three samples) than yellow was. Participants in the religious setting (all three samples) used yellow more often as the main colour. As for the blue colour, although our results they did not qualify as significant, we note that participants in



**Fig. 8.3** Six drawings randomly selected from those showing orange as the most used colour (first colour) (<http://ark.dasch.swiss/ark:/72163/1/0105/fL0E98zRQHqJ7RwZuQa1zgj.20200407T134513775776Z>, <http://ark.dasch.swiss/ark:/72163/1/0105/NCsAzDTpQ0qPIEL1VkJ6AQ.20180702T185445084Z>, <http://ark.dasch.swiss/ark:/72163/1/0105/CjMDUzWCQHSFhGvfzW87YAp.20180702T190536819Z>, [http://ark.dasch.swiss/ark:/72163/1/0105/2O7\\_NopZTye\\_R8vr5XS\\_oQz.20201009T113024420355Z](http://ark.dasch.swiss/ark:/72163/1/0105/2O7_NopZTye_R8vr5XS_oQz.20201009T113024420355Z), <http://ark.dasch.swiss/ark:/72163/1/0105/iAruZWuOTcOLYBLqPgzzigI.20200415T110229178117Z>, <http://ark.dasch.swiss/ark:/72163/1/0105/BtFPA2DnS2K=S9ePHep28gv.20180702T190734383Z>)

the religious setting in two of the three samples (Japanese and Swiss, but not Russian-Slavic) used more blue in their drawings.

## General Discussion

The aim of the present research was to investigate colour in children's drawings of god collected in four groups of participants characterized by different cultural and religious environments: Japanese (Buddhism and Shinto), Russian-Buryat (Buddhism, Shamanism), Russian Slavic (Christian Orthodoxy) and French-speaking Swiss (Catholic and reformed Christianity). We hypothesized that the topic of the drawing would have a strong influence on the way the children would



**Fig. 8.4** Six drawings randomly selected from those showing blue as the most used colour (first colour) (<http://ark.dasch.swiss/ark:/72163/1/0105/4cC4qKkXQLW8oSPAT6aADwp.20200906T105031714076Z>, <http://ark.dasch.swiss/ark:/72163/1/0105/J0S5IzJdT1m=4qiYkq=oyAm.20201018T102738211445Z>, [http://ark.dasch.swiss/ark:/72163/1/0105/\\_BiJTMcGQAOG97ZI=cgGmQm.20201025T133709338444Z](http://ark.dasch.swiss/ark:/72163/1/0105/_BiJTMcGQAOG97ZI=cgGmQm.20201025T133709338444Z), [http://ark.dasch.swiss/ark:/72163/1/0105/xC5uYo4MQm6v4eGFF4I\\_FgW.20180702T155057937Z](http://ark.dasch.swiss/ark:/72163/1/0105/xC5uYo4MQm6v4eGFF4I_FgW.20180702T155057937Z), [http://ark.dasch.swiss/ark:/72163/1/0105/A\\_4Sv4cyQoGHuAGEEEEdK7Qd.20201010T084817145761Z](http://ark.dasch.swiss/ark:/72163/1/0105/A_4Sv4cyQoGHuAGEEEEdK7Qd.20201010T084817145761Z), <http://ark.dasch.swiss/ark:/72163/1/0105/=dbCBGWWSNmRmtdtMJ5AAq.20200906T081020386126Z>)

**Table 8.9** Proportion analysis for most used colours (achromatism, yellow, and blue) by country and/or culture

Colour	Japan	Russian-Buryat	Russian-Slavic	Switzerland	$\chi^2$
Achromatism	76 (53.5%)	89 (38.5%)	118 (39.1%)	285 (55.2%)	$\chi^2[3] = 30.5, p < .001$
Yellow	27 (19.0%)	53 (22.9%)	78 (25.8%)	79 (15.3%)	$\chi^2[3] = 14.9, p = .006$
Blue	11 (07.8%)	33 (14.3%)	63 (20.9%)	88 (17.1%)	$\chi^2[3] = 13.1, p = .013$

select colours. Specifically, we hypothesized that yellow and blue would be the main colours used by the children. We hypothesized the yellow because bright colours, such as white and yellow, are often used to depict the divine radiance and light

**Table 8.10** Proportion analysis for achromatism, yellow, and blue by gender, for the whole dataset

Colour	Females	Males	$\chi^2$
Achromatism	247 (41.0%)	231 (54.6%)	$\chi^2[1] = 21.6, p < .001$
Yellow	132 (21.9%)	105 (17.9%)	$\chi^2[1] = 14.9, p = .284$
Blue	116 (19.2%)	79 (13.4%)	$\chi^2[1] = 06.9, p = .026$

**Table 8.11** Proportion analysis for achromatism, yellow, and blue used as the first colour by gender and country and/or culture

Colour	Sample	Females	Males	$\chi^2$
Achromatism	Japanese	27 (45.0%)	49 (59.8%)	$\chi^2[1] = 2.5, p = 0.348$
	Russian-Buryat	36 (31.0%)	53 (46.1%)	$\chi^2[1] = 4.9, p = 0.080$
	Russian-Slavic	53 (33.5%)	65 (45.1%)	$\chi^2[1] = 3.8, p = 0.155$
	Swiss	131 (48.7%)	154 (62.4%)	$\chi^2[1] = 9.2, p = 0.007$
Yellow	Japanese	12 (20.0%)	15 (18.3%)	$\chi^2[1] = 0.0, p = 1.000$
	Russian-Buryat	27 (23.3%)	26 (22.6%)	$\chi^2[1] = 0.0, p = 1.000$
	Russian-Slavic	45 (28.5%)	33 (22.9%)	$\chi^2[1] = 0.9, p = 0.993$
	Swiss	48 (17.8%)	31 (12.6%)	$\chi^2[1] = 2.4, p = 0.367$
Blue	Japanese	7 (11.7%)	4 (04.9%)	$\chi^2[1] = 1.4, p = 0.718$
	Russian-Buryat	18 (15.5%)	15 (13.0%)	$\chi^2[1] = 0.1, p = 1.000$
	Russian-Slavic	34 (21.5%)	29 (20.1%)	$\chi^2[1] = 0.0, p = 1.000$
	Swiss	57 (21.2%)	31 (12.6%)	$\chi^2[1] = 6.2, p = 0.038$

in religious iconographies; we hypothesized the blue because of its association with the sky, a place in which children often depict god to be.

As predicted, the results of the present study largely support this hypothesis, although the achromatic colour scheme (black and shades of grey) was most widely used, followed directly by yellow, orange, blue, and red. This mean that after drawing contours in achromatic colours,<sup>5</sup> children in all samples used yellow and blue to depict god and the background in which they place it. Actually, children commonly used yellow to express light: light as a representation of god itself, or light as emanating from the god, (orange and red were used less often for depiction of the light, and if they were used, they were usually mixed with yellow). This result is largely consistent with historical and religious studies that elucidate the symbolic value of the light across a great variety of religions. From earliest times, light was perceived as the indication of a transcendent realm or as a manifestation of the gods themselves (Herrstrom, 2017). Further, Kapstein (2004, preface, ix) states, “images of light must hold pride of place” between themes suggesting a universal basis for religious intuition and experience. In this sense, results of the present study, using a large cross-cultural dataset, corroborate the view that light imagery and light symbolism have a very special place in religion. Why is light so essentially associated with the divine? One of possible explanation comes to us by way of recent studies inspired by the theory of conceptual metaphor (Lakoff & Johnson, 1980). They showed that light is used pervasively to represent positive concepts, while darkness

<sup>5</sup>It should be noted here that many children (7.9%), especially older, made their drawings using only graphite pencil.



**Table 8.12** Proportion analysis for achromatism, yellow, and blue used as the first colour by age groups for the whole dataset

Colour	Young	Middle	Old	$\chi^2$
Achromatism	162 (40.9%)	194 (49.6%)	212 (52.5%)	$\chi^2[2] = 11.6, p = .009$
Yellow	59 (14.9%)	74 (18.9%)	104 (25.7%)	$\chi^2[2] = 15.1, p = .002$
Blue	83 (21.0%)	65 (16.6%)	47 (11.6%)	$\chi^2[2] = 12.7, p = .005$

**Table 8.13** Proportion analysis for achromatism, yellow, and blue used as the first colour by age groups and country and/or culture

Colour	Sample	Young	Middle	Old	$\chi^2$
Achromatism	Japanese	27 (55.1%)	28 (56.0%)	21 (48.8%)	$\chi^2[2] = 0.6, p = 1.000$
	Russian-Buryat	20 (24.7%)	26 (38.8%)	43 (51.8%)	$\chi^2[2] = 12.7, p = 0.005$
	Russian-Slavic	27 (28.4%)	47 (42.0%)	44 (46.3%)	$\chi^2[2] = 7.0, p = 0.090$
	Swiss	88 (51.5%)	93 (57.4%)	104 (56.8%)	$\chi^2[2] = 1.5, p = 1.000$
Yellow	Japanese	5 (10.2%)	11 (22.0%)	11 (25.6%)	$\chi^2[2] = 4.0, p = 0.413$
	Russian-Buryat	12 (14.8%)	16 (23.9%)	25 (30.1%)	$\chi^2[2] = 5.5, p = 0.194$
	Russian-Slavic	21 (22.1%)	28 (25.0%)	29 (30.5%)	$\chi^2[2] = 1.8, p = 1.000$
	Swiss	21 (12.3%)	19 (11.7%)	39 (21.3%)	$\chi^2[2] = 7.9, p = 0.058$
Blue	Japanese	4 (08.2%)	3 (06.0%)	4 (09.3%)	$\chi^2[2] = 0.4, p = 1.000$
	Russian-Buryat	17 (21.0%)	10 (14.9%)	6 (07.2%)	$\chi^2[2] = 6.4, p = 0.124$
	Russian-Slavic	28 (29.5%)	23 (20.5%)	12 (12.6%)	$\chi^2[2] = 8.2, p = 0.050$
	Swiss	34 (19.9%)	29 (17.9%)	25 (13.7%)	$\chi^2[2] = 2.5, p = 0.843$

is associated with negative concepts (Lakens et al., 2013; Sherman & Clore, 2009; Chiou & Cheng, 2013). This apparently common association is generally interpreted physiologically (by the fact that humans are diurnal animals) and psychologically (thus, they do not feel safe in the dark) (Lakens et al., 2013). Parallel to these studies, research on the affective valence of specific colours and the emotional content of children’s drawings revealed that overall children use lighter colours to depict figures they regard positively, and they use darker colours to depict figures that they regard negatively (Golomb, 2004; Burkitt, 2008). As an example from research where children were limited the choice of only one colour per drawing, children often selected the colour yellow when drawing a happy figure; they chose brown or black when drawing a sad figure (Burkitt & Newell, 2005; Burkitt & Sheppard, 2014). However, this explication for our results is rather speculative because this study did not account for the level of religious commitment or the positive or negative attitude toward a god figure. As for the colour blue, we could explain the common choice of this colour in representations of god by noting that participants frequently used blue to draw the sky. Actually, using the same data as the present study, Dandarova-Robert et al. (Chaps. 6 and 7, this volume) found that across all sample groups, children who included a background in their picture, most frequently positioned god’s dwelling place in the sky. We note that more detailed research is needed in order to distinguish between colours used to depict god figures and those used to depict background features. For instance, many children depict blue-robed god figures.

**Table 8.14** Proportion analysis for achromatism, yellow, and blue used as the first colour according to the schooling context

Colour	Sample	Regular	Religious	$\chi^2$
Achromatism	Japanese	38 (64.4%)	38 (45.8%)	$\chi^2[1] = 4.1, p = 0.130$
	Russian-Buryat	–	–	–
	Russian-Slavic	80 (40.0%)	38 (37.3%)	$\chi^2[1] = 0.1, p = 1.000$
	Swiss	126 (56.0%)	159 (54.6%)	$\chi^2[1] = 0.0, p = 1.000$
Yellow	Japanese	8 (13.6%)	19 (22.9%)	$\chi^2[1] = 1.4, p = 0.714$
	Russian-Buryat	–	–	–
	Russian-Slavic	51 (25.5%)	27 (26.5%)	$\chi^2[1] = 0.0, p = 1.000$
	Swiss	29 (12.9%)	50 (17.2%)	$\chi^2[1] = 1.5, p = 0.668$
Blue	Japanese	4 (06.8%)	7 (08.4%)	$\chi^2[1] = 0.0, p = 1.000$
	Russian-Buryat	–	–	–
	Russian-Slavic	45 (22.5%)	18 (17.7%)	$\chi^2[1] = 0.7, p = 1.000$
	Swiss	35 (15.6%)	53 (18.2%)	$\chi^2[1] = 0.5, p = 1.000$

Despite the similarities between samples with regard to the use of what we have identified as main colours (achromatism, yellow, and blue), the current study found that colour choices could also vary by culture. Thus, more of the Russian children from both samples (Russian-Slavic and Russian-Buryat) used yellow as their main colour. The Japanese and the Swiss children used the choice of achromatic colour more often than the children in the two Russian samples did. More Russian-Slavic and Swiss children used blue as their first choice than did Russian-Buryat or Japanese children. This last finding could be due to the higher percentage of self-identified Christians in these samples. Christian iconography often depicts the figure of god in the sky; past exposure to this iconography may have led children to use the colour blue in a similar way.

Regarding the effects of age and gender, our research revealed significant differences in the use of some colours. While the use of achromatism or yellow as main colour increased with age, the use of blue decreased with age. We could speculate that older children paid more attention to making clear outlines of the figures. They often used achromatic colours to achieve this goal. Our observation here is consistent with earlier studies, which found that older children make more choices about colours, or they choose to draw with only a pencil in order to obtain monochromatic drawings (Richards & Ross, 1967; Golomb, 2004; Dandarova, 2013). Older children used yellow as their first colour choice significantly more often than younger children did. We could thus presume that older children use light as one of god's attributes or they associate god representations with light to a greater extent than the children in the middle and in the young age groups do. Finally, the age difference seen in the use of the colour blue could be explained by the fact that younger children include a blue sky as a background feature in their representations more often than older children do. With regard to gender-related differences, we found no significant effects related to the use of yellow as the main colour. We did find that significantly more boys used achromatism as the main colour than girls did, which is consistent with previous studies (Tuman, 1999; Boyatzis & Albertini, 2000).

Additionally, we found that in the Swiss sample, more girls used blue as the main colour than boys did.

With regard to the context of schooling, we found no significant differences between drawings collected in religious schools and those collected in regular schools. We did note, however, that although the results did not qualify as significant, achromatism was used less frequently as the main colour in religious settings (across all three samples: Japanese, Russian-Slavic, and Swiss) than in regular schools. By contrast, we found that yellow appeared more frequently as the main colour choice in religious settings (again, across all three samples). Additionally we found that in the religious schools of Japan and Switzerland, children chose blue as the main colour most often. Our findings of our present study do not reflect either a measure a level of religious commitment or a positive/negative attitude toward god. Consequently participants the regular school context might be also—or even more—aware of certain religious symbols and beliefs as the children from the religious school context. We need more detailed research that uses the complementary metadata in order to study the impact of the level of religious commitment and the positive/negative attitude toward god on colour use in drawings of the divine.

Finally, regarding the number of colours used by the participants, the mean number of colours (from 4.69 to 5.18) was almost the same across all of the cultural samples. Results also revealed that number of colours used could be a function of participant's age and gender. There was a significant difference between the numbers of colours used in each age group, with a tendency for older children to use less colours than younger ones, except in the Japanese sample. We also found significant gender differences: girls used more colours than boys did, across all samples. Our results show consistency with previous studies; girls choose to use more colours, while boys choose to use more achromatism (Richards & Ross, 1967; Tuman, 1999; Boyatzis & Albertini, 2000; Wright & Black, 2013; Iijima et al., 2001; Alter-Muri & Vazzano, 2014).

## Conclusion

Colour remains a neglected aspect in the history of religious art as well as in of the study of children's artistic expression in this domain. The present research addressed this important gap and provides a unique contribution to expanding psychological research on religious representations and conceptualization of the divine. We showed that, when drawing god, children from different cultural and religious environments: Japanese (Buddhism and Shinto), Russian-Buryat (Buddhism, shamanism), Russian Slavic (Christian Orthodoxy) and French-speaking Swiss (Catholic and reformed Christianity), often imagine and depict god using the same colours: primarily yellow and blue. Apparently, yellow often supplies a connection to light; children often represented god in light or as light using yellow to communicate these concepts. The very few differences found between samples according the variables of age, gender, and religious or regular type of schooling further highlight

similarities across cultures and religions. This finding largely corroborates existing studies showing the special role and religious meaning of light in representations of the divine (Weightman, 1996). In fact, light in general and sun-light in particular serve as prominent and powerful symbols in many cultures and religions (Giannakis, 2001). Light could be considered as one of the physical attributes of the divine and it also could be directly associated with god. In some religions, the direct association of light with god is a consistent pattern. For instance, light often symbolizes the essence of God throughout the Old and New Testament (Zuiddam, 2018). Moreover, we find a vast array of solar deities and their worship throughout the humanity history: Ra, the ancient Egyptian deity of the sun; Amaterasu, the goddess of Sun in Shinto; Dazhbog, the god of Sun in the earliest Slavic religions, etc. In many religious iconographies from ancient Egyptian religions to modern day Christianity, Islam, and Buddhism, artists traditionally depict the light and the divine radiance by using materials such as gold and silver (Zorach & Phillips, 2016). When gold or silver were (or are) not available, artists used yellow or white to depict the light and the divine radiance (Kenna, 1985). In our research we see that children follow the same strategy: They use yellow (less so white because in these studies the paper itself is white) to draw light around god's heads or around the whole body to indicate its divine or sacred status.

The present research also contributes to the growing body of evidence found in studies that have been done using the embodied or grounded cognition approach. Our findings support an association of the metaphors of light and brightness with positive concepts such as goodness, morality, intelligence, knowledge, purity, and cleanliness, although further research is needed to deepen our knowledge of colours used in representing the divine and the eventual association of bright colours (yellow and white) with a positive or negative attitude toward god.

## Limitations

Some limitations should be noted. First, the automated method of colour identification that we developed does not allow us to separate the white color of drawn elements (body parts, clothes or some elements of background like clouds) from the white color of the sheet of paper. Consequently, we have no information about the factual use of the colour white in children's drawings of god. This is especially regrettable when consider that white is often used to depict divine radiance or to represent divine beings like angels. Future research is needed to remedy this problem. One possibility solution would be to use the computerized annotation tool, which would allow us to analyse only the colours within the annotated zone. This could allow us to better distinguish between the representation of god and any drawn background features or portions of blank paper.

Another limitation that became evident to us during the course of research is that we did not take into consideration the impact of the children's level of religiosity and their positive or negative attitude toward the god figure. It is evident that the

division of the samples according to the type of schooling did not permit us to distinguish between believers and non-believers, between children who intentionally practice religion and those who affiliate (formally) with a particular confessional group, but do not actively practice their religion. Moreover, a positive or negative attitude toward the god figure could influence the children's choice of colours. It is possible that the use of yellow could be dependent upon these factors.

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