



Biological Basis of Aesthetics: A Comparison of Rock Art and Ape Art

by Anne Zeller*

ABSTRACT

Through an interest in the origins of a wide variety of human behaviours I began to collect the drawings and paintings done by Apes and young Children. I wanted to investigate the argument put forward by some individuals that these works were merely "random scribbles", since the use of colour, balance and pattern gave some of this material such appeal that they were sold quite well to art collectors and were even hung by such famous painters as Picasso. An investigation of 396 works by Chimpanzees, Gorillas, Orangutans and Children revealed that there were many specific regularities in colour choice, use of space and pattern choices. Some of these choices were almost universal while others were significantly different between species. This argues strongly that the process was not random, and thus that the outcome could be said to reflect the aesthetic choices of the individuals. When I began to examine non-figural rock art, it appeared that these were some regularities in pattern which could be compared with the previous study. In particular, I became intrigued with the non-figural lines which were 'suggestive' and looked at the ape material to see if such pre-representational aspects occurred. The discovery of such potentials is an exciting indication of a possible bridge between non-representational and representational art.

RIASSUNTO

Seguendo il mio interesse nei confronti dell'origine di una vasta gamma di comportamenti umani, ho iniziato a raccogliere i disegni e i dipinti realizzati dalle scimmie antropomorfe e dai bambini. Mia intenzione è quella di smentire la tesi secondo cui questi lavori siano semplici "scarabocchi", visto che l'utilizzo particolare del colore, il bilanciamento cromatico e la trama di questi disegni fa sì che riscuotano l'interesse dei collezionisti e di altri grandi artisti come Picasso. Un'indagine svolta su un campione di 396 lavori realizzati da scimpanzé, gorilla, orangutanghi e bambini, rivela che c'è una certa regolarità nella scelta dei colori, nell'uso dello spazio e nella creazione della trama. Alcune di queste scelte sono pressoché universali, mentre altre differiscono parecchio da una specie all'altra. Tutto questo suggerisce che il processo non sia affatto casuale, ma che il risultato riflette le scelte estetiche dell'individuo. Quando ho iniziato ad esaminare l'arte rupestre non figurativa, è emerso che alcune rappresentazioni grafiche avevano una trama comparabile a quelle studiate precedentemente. In particolare, la mia attenzione è stata catturata dalle linee non figurative in un certo senso "evocative", poiché mi hanno portato a verificare se tali aspetti pre-figurativi fossero presenti anche nel materiale prodotto dalle scimmie. La scoperta di questo potenziale indica che probabilmente vi è una relazione tra arte non-figurativa e arte figurativa.

INTRODUCTION

Anthropologists have long been intrigued by the cave and rock art of prehistoric people. In particular, the painting skills of Cro Magnon people are considered remarkable because of the lack of precursor material from earlier hominid forms, other than incised lines on bone and antler. One way to approach the question of the source of aesthetic development is to investigate the artistic potential of our closest living relatives, the great apes, attempting to discover whether they manifest behaviours which could be considered the precursors of human capabilities.

Over the past 13 years, I have gathered examples of painting and drawing done by chimpanzees, gorillas and orang-utans and young children which suggest that their output has evidence of regularity and

* Anne Zeller
Department of Anthropology
University of Waterloo
Ontario, Canada
azeller@watarts.uwaterloo.ca



choice, resulting in pictures which human observers consider to have aesthetic values (Zeller 1996). These values are based on choices of colour, direction of line, placement, pattern use, negative space, and a non-metric quality I have called balance. In particular, first colour choice, last colour choice, use of negative space, and pattern use show high levels of regularity based on statistical analysis across the three ape species, and the human children with whom I compared them. I then compared the results of this study with a similar analysis of 26 rock art pictures by prehistoric peoples from Europe, North America and Africa (Zeller 2006). These results provide a glimpse into the mental processes of our closest living relations in terms of their aesthetic choices and may provide some clues about the transition from pre-hominid to human aesthetics.

My initial interest in 'Ape Art' arose from the awareness that these productions were often very pleasing to look at and frequently elicited a lot of positive comment from viewers. Some individuals were willing to pay substantial sums of money for these and to display them with other works of art (Boysen et al 1987). Others claimed that the works were merely random splashes of colour with no form, intention or emotional attraction. I decided to investigate the issue of whether these productions were just random applications of paint or crayon or if there were any regularities in the productions of work by various ape species. In addition, I was interested to see whether there were regular differences between chimpanzee, gorilla and orang-utan paintings/drawings and those of pre-representational human children. My 13-year study of 'Ape Art' indicates that the works produced are not random aggregations of colour and form but display regularities both within and between three species of apes and human children. This paper compares some aspects of non-figural rock art done by prehistoric populations with the productions of apes and children, to investigate the question of a possible level of similarity in some of the aesthetic choices made by both groups. This study is not intended to diminish the artistic value of cave paintings/rock art but to suggest that some of the underlying choices of colour and form may have roots that precede the development of the genus *Homo*. In particular, I propose to compare basic attributes such as number of colours used, which colour is most frequent, respect for picture boundaries, and the types of patterns used (see Graph 1). Obviously, human figural art is an entirely different matter but in many cases of cave/rock art, figures and non-figural components are mixed. This study will focus on the non-figural aspects but will briefly discuss the attribution of representationality to pictures.

SYNOPSIS OF APE ART RESEARCH

The original study, consisting of 396 non-figural drawings done with paint, crayon or coloured markers by apes and young children (see Chart 1), shows a variety of regularities and similarities which suggest that initial choices are being made by these individuals when making pictures. For example, although the colour blue was used most frequently by every species except orang-utans who used it second most frequently (see Chart 2), the initial colour put onto the page by every species was most frequently yellow, by a very large margin (significance level $P < .001$) (see Chart 5). When first colour use was subdivided by sex as well as species, all groups except female humans used yellow first most frequently (see Graph 2). This regularity is complemented by a pattern of second first colour choice being green in human and chimpanzee work and red in gorillas and orang-utans (see Graph 3). However, as previously mentioned, blue was actually the colour most frequently used overall. This is supported by Sally Boysen's work with her painting chimpanzees (p.c.) in which they choose blue most often when presented with 8 choices of colour. Overall, the outcome of these preferences for various colours resulted in multiple colour pictures with the modal number of colours used in a picture being four, although the numbers ranged from one to seven (see Charts 3 and 4). All the species also mixed colours to make novel ones of their own choosing in 22.9% of their pictures (91 out of 396) with Novel brown being made by all four groups (see Chart 6). Females used novel colours more often than males at a $P < .05$ level (37.9% vs 20.4%).

Another major area of species regularity was pattern use. Diagram 1 outlines the various patterns used by the apes and children. Graph 1 indicates the relative frequencies of the various patterns used by each group indicating some levels of regularity and some differences between species. The straight line is most frequent for all species, but after that, there is some variability with chimpanzees, gorillas and orang-utans using the arc most while human children preferentially use the connected line. The human children's other patterns are spread fairly evenly through all of the other original nine patterns, while each of the ape species tends towards its own focus. In fact, in many cases, I can distinguish the work by particular ape species from a combination of pattern use, orientation and use of negative space.

The use of negative space is a rather sophisticated aspect of artistic expression because it precludes the approach of just smearing paint all over. Gorillas tend to use the smear pattern more than others and consequently have a lower frequency of pictures showing negative space. Proportionally, chimpanzees show a much higher frequency of negative space in their works (see Chart 7) and (see Fig. 1). Whether or not the edges of the paper were touched was used as a surrogate for respect for boundaries, or the concept that

a picture should be contained inside a frame. Chimpanzees went off the page more frequently than other species, with orang-utans next and human children the least. This does suggest that human children have more of a boundary concept, although when males and females were compared, human males were not as respectful of page boundaries as male orang-utans (see Chart 8 and Diagram 2).

COMPARATIVE STUDY

The comparison with cave/rock art was made by assessing 25 pictographs and 1 petroglyph acquired from a variety of sources. These included 13 European examples, 9 North American pictographs, 1 petroglyph and 3 African examples, but European material was taken from published sources since individual photography is generally forbidden. The petroglyph was included because of its complex patterning, but was not included in the colour analysis. Drawings which were purely figural were omitted. Of the 26 pictures analyzed, 14 are mainly figural, 7 have suggestions of figures, and 5 have no discernible representation. In order to compare the concept of respect for boundaries (since all of these drawings are on large rock walls) I substituted the concept that the figures or lines of the drawings overlapped other drawing fields. Of all the pictures, 17 or 65% showed overlap while 9 or 35% did not (see Chart A). This compares with an average of 80.9% of ape pictures touching a border. Drawings by human children only touched the boundaries 47.2% of the time. A major difference between the rock art and the other study was that a majority of rock art pictures used only 1 colour. This was most frequently red (in 9 cases or 34%) but black and a Novel brown were also used alone (see Chart A). The range of colours used was from 1 to 3 (see Chart A) but the variety of colours used was 5, including two pictures in which brown was used. In at least one of these, it is clear that the brown is constructed out of a mixture of red and black pigments.

The most noticeable area of similarity between the two studies was in the patterns used. The non-representational marks made by rock artists included all of the patterns used by the ape/human group and, in addition, they used the square/rectangle – a 4-sided shape made with straight lines (see Fig. 4). Both groups used the straight line most frequently and the cross and closed roving very infrequently. However, the rock artists used the circle and spot much more. (see Graph 1 and Fig. 2).

DISCUSSION

The characteristics of colour choice and number of colours used in rock art that we can examine is constrained by both the pigments available and their permanence. It is quite possible that other more fugitive colours were used, but have disappeared over the last 20,000 years. However it does seem clear that red, black and yellow were available to both Europeans and North Americans while yellow, black and white were commonly used in Africa.

The high frequency of one colour pictures, mainly using red ochre as a pigment, is undoubtedly due to its bright colour and relative permanence as well as its ubiquity. A number of other representational American rock art pictographs had other colours such as blue and black incorporated but unicolour red figure drawings are frequent and widespread. Thus, the higher frequency of unicolour red drawings is characteristic of rock art and differs somewhat from the ape/child study with its modal number of 4 colours with blue and red most frequent, followed by yellow and green.

The areas of greatest similarity were the high rates of overlap which I correlated with transgressing the page boundary in the ape study and the frequency of use of various patterns in making the drawings. The frequency of overlapping pictures in rock art has always been a source of puzzlement to modern researchers. Perhaps because of the conventions of modern art, we tend to see figural art as an attempt to represent reality and overlap, therefore, has conventionalized meanings, such as indication of perspective, movement (Giacomo Balla; Marcel Duchamps) or reinforcement. Also, relative sizes are frequently seen as having symbolic indications if they are not a replication of nature. Since this paper is not directly concerned with figural rock art, I will leave the discussion here, but do note that non-figural lines also overlap figures. In some cases, these are scratches or apparent wound marks on animals. In others, they are spots, roving lines or other rather obscure marks.

In situations of non-figural rock markings, in some cases the overlap is extensive and rather chaotic. To me, the overlap indicates that it is the process of creation rather than the finished product that is the relevant motivator of the activity. In the ape/child study, the high frequency of boundary transgression would support the same argument, but the tendency of children to stay within the page edges suggests that they may be being socialized to a more contemporary human perception of "a picture". It is also true that about a quarter of the ape productions do not transgress page boundaries (see Diagram 2). This is not to say that ape drawings are always centered on the page. In fact, placement on the paper is quite variable among species. In addition, experimental work in which pre-marked papers are presented to apes and some of them focus on the marks, or make a balancing mark on the paper, suggests that they do have some concept of boundary (Schiller 1951; Thierry 1977).



The major aspect of comparison between the ape study and the analysis of rock art, in addition to colour use, is patterning. The set of 10 patterns was developed by assessment of the original study pictures. Single and multiple manifestations of a line direction were collapsed to form the 10 categories.

Rock artists used straight lines most frequently, followed by curves. These two patterns were also most frequent in the apes, generally speaking. More complex patterns such as dots/spots and squares were used more frequently by rock artists than by apes/children. However, the difference suggests a trend towards increased complexity rather than a statistically significant difference. The circle was used slightly more often by gorillas than in rock art, as was the case with the cross where chimpanzees used the pattern a little more than rock artists. There has been a lot of argument concerning whether mastering the circle is the first stage of representational drawing. The early work concerning human representational drawing suggests that the plain circle is followed by circles with internal marks, which rapidly become indicators of eyes, mouth, etc. even when bodies are very sketchy or absent (Schretlen 2004). A few researchers are not willing to consider a round shape with significant overlap of ends as a circle, or a shape which is actually more oval (Schretlen 2004), while others accept any relatively circular closed loop form as a circle. This is not frequent in ape art, but it certainly does occur (see Fig. 3).

The square or rectangle made up of 4 straight, connecting lines is unique to adult human rock painters in this study and does suggest a more complex relational ability, as well as improved hand/eye coordination (see Fig. 4). The open and closed roving lines are more widely used by the apes/children than by the adult humans. The similarity in frequencies of all of these patterns, as demonstrated in Graph 1, strongly support the argument that non-representational drawing by rock artists is based on a foundation derived from earlier stages of development.

DEVELOPMENT OF REPRESENTATION

Many of the patterns can evoke feelings and interpretations in viewers, such as a winding line (open roving pattern) which can be interpreted as the outline of a bull or deer even when considerably out of proportion (see Fig. 5). Thus, it is possible to argue that the development of representation was based on an interaction between the early viewers and the artists. As with the development of the circle, which may be the initial goal but is then incorporated into a more representational depiction, roving lines could develop into the beginnings of representation. To support this argument, I invite you to look at two ape paintings, done by the gorilla named King, in my presence. King's trainer asked him to draw himself and the result is the black picture (see Fig. 6). She then asked King to draw me and the result is the pink picture (see Fig. 7). These are not representational in the absolute sense of the word but they show patterned differences germane to the requests. King always painted gorillas in black and humans in pink. The shape of the gorilla face is much longer than mine. I am not arguing that these are representational drawings but that they have aspects that humans can recognize. Feedback from viewers who interpret the drawings could induce early artists to approach representation more closely. As a possible driving mechanism behind the development of early artistic expressions, this idea is worth investigating. The development of representation probably occurred in carving as well, and may be even earlier than in rock art, but the idea of a found object which had suggestive lines leading a viewer to see a form in a bone or rock could also be a precursor to a line which could be filled in with the imagination to be the outline of a form. Some of the signing apes have very recognizable, labelled patterns for their drawings, such as Tatu's 'ice cream', which is recognized as such by other signing chimpanzees (see Fig 8). This suggests that they do have some internalized ideas of what it is that they are drawing. Considering that finger marks in clay, scratches on rock, and incorporations of natural contours into the outlines of animals to give them a realistic form all occur in rock art in Europe, it seems reasonable to argue that early artists were capable of seeing beyond the obvious, to attribute representation to outlines. They were not using naturalistic colours, and colour may very well have come to possess symbolic meaning. We do not know why cave paintings were produced but even the non-figural aspects are not, in all likelihood, accidental or random.

CONCLUSION

Although the numbers of colours and actual colours used most frequently are not the same in the ape/child and rock art study, they cover the same fairly constrained range. The similarity in frequency of patterns used between the two groups does indicate a level of continuity in the choices that they make when engaged in non-representational drawing. The potential for representation could develop from these lines, which develop into outlines and, eventually, forms. An argument is presented that the development of representation may have arisen partly out of interaction between the viewer and artist. Thus, as the work becomes more accessible to the viewer, aspects such as colour, balance, form and meaning will increase its aesthetic value to the observer.

CHART 1
NUMBERS OF PARTICIPANTS BY GENDER

Totals	pics	males	females	male pics	female pics
Chimpanzee	40	3	5	17	23
Gorilla	153	15	2	150	3
Human	57	6	8	14	43
Orang utan	146	4	8	125	21
Total	396	28	23	306	90

CHART 2
LIST OF COLOURS

		Totals	Chimp	Gorilla	Orang utan	Human
bl	blue	243	20	102	91	30
r	red	238	15	97	97	29
g	green	215	26	82	79	28
y	yellow	207	21	90	76	20
pu	purple	115	13	54	39	9
o	orange	78	8	18	33	19
bk	black	31	6	5	5	15
p	pink	26	5	5	9	7
br	brown	18	7	2	3	6
s	silver	15	0	9	6	0
w	white	7	2	2	3	0
t	tan	6	0	0	2	4
gr	gray	5	1	0	1	3

OTHER

wa	water	9	2	0	4	3
----	-------	---	---	---	---	---

NOVEL COLOURS

Nb	Novel brown	43	6	17	16	4
Ng	Novel green	28	4	14	10	0
Npu	Novel purple	8	2	3	3	0
Nbk	Novel black	6	1	2	3	0
No	Novel orange	6	1	3	2	0

CHART 3
NUMBER OF COLOURS USED IN PICTURES

of Colours	Human		Chimp		Gorilla		Orang Utans		Totals	
	#	%	#	%	#	%	#	%	#	%
1	5	8.7	5	12.1	6	3.9	5	3.4	21	5.3
2	13	22.8	6	14.6	20	13.2	19	13	58	14.6
3	11	19.3	8	19.5	38	25	40	27.4	97	24.5
4	14	24.5	14	34.1	64	42.1	64	43.8	156	39.3
5	6	3.8	6	14.6	20	13.2	15	10.3	47	11.9
6	7	12.3	2	4.8	4	2.6	3	2.1	16	4.0
7	1	1.75	0	-	0	-	0	-	1	0.25
	57		41		158		146		396	



**CHART 4
NUMBERS OF COLOURS USED BY GENDER**

Number of Colours	Male %	Female %
1	3.0%	14.9%
2	13.7%	13.3%
3	25.8%	19.5%
4	43.5%	25.4%
5	8.7%	20.7%
6	4.3%	4.6%
7	0	1.1%

**CHART 5
FIRST COLOUR - SPECIES COMPARISON**

Species	Total	Yellow	%	Red	%	Blue	%	Green	%	Orange	%	Pink	%	Purple	%
Human	57	17	29.3	5	8.6	3	5.1	12	20.6	3	5.1	5	8.6	5	8.6
Chimp	40	17	42.5	2	5.0	3	7.5	7	17.5	4	10	3	7.5	1	2.5
Gorilla	153	85	55.5	22	14.4	17	11.1	10	6.5	9	5.9	2	1.3	1	0.6
Orangs	146	59	40.4	28	19.1	20	13.7	13	8.9	13	8.9	8	5.5	5	3.4

Black, brown, silver, and Nbr have some cells of 0.

**CHART 6
USE OF NOVEL COLOUR**

Novel colour	Chimp	%	Gorilla	%	Orang utan	%	Human	%	Totals	
									#	%
-Green	4	9.8	14	9.2	10	6.8	0	-	28	31.1
-Purple	2	4.9	3	2	3	2.1	0	-	8	8.9
-Brown	6	42.8	17	48.5	16	47	4	100	43	47.8
-Orange	1	2.4	3	2	2	1.4	0	-	6	6.6
-Black	1	2.4	2	1.3	3	2.1	0	-	6	6.6
Totals	14	34.1	39	25.6	34	22.9	4	7	91	22.9

% Total Pictures:

Brown	10.8%
Green	7.1%
Purple	2.0%
Orange	1.5%
Black	1.5%

CHART 7
USE OF NEGATIVE SPACE BY GENDER AND SPECIES

	Gorilla		Chimp		Orang utan		Human		Total	
Male	$\frac{33}{150}$	22%	$\frac{10}{17}$	58.8%	$\frac{51}{126}$	40.4%	$\frac{7}{14}$	50%	$\frac{101}{307}$	32.8%
Female	$\frac{1}{3}$	33.3%	$\frac{13}{23}$	56.5%	$\frac{9}{20}$	45%	$\frac{16}{43}$	37.2%	$\frac{39}{89}$	43.8%
Total by Species	$\frac{34}{153}$	22.2%	$\frac{23}{40}$	57.5%	$\frac{60}{146}$	40.8%	$\frac{23}{57}$	40.3%	$\frac{140}{396}$	35.6%
% of Total Pictures	$\frac{34}{396}$	8.6%	$\frac{23}{396}$	5.8%	$\frac{60}{396}$	15.2%	$\frac{23}{396}$	5.8%	$\frac{140}{396}$	35.6%

CHART 8
NUMBER OF EDGED TOUCHED BY SPECIES (SEE DIAGRAM 2 FOR EDGE NUMBERING)

# of edges touched	H u - man		Chimp		Gorilla		Orang utan		Totals	
	#	%	#	%	#	%	#	%	#	%
0	30	52.6	12	29.2	42	27.6	69	47.2	153	38.6
1	9	15.7	7	17.1	50	32.8	34	23.3	100	25.3
2	10	17.5	7	17.1	32	21	27	18.5	76	19.2
3	6	10.5	9	22	21	13.8	12	8.2	48	12.1
4	2	3.5	6	14.6	6	3.9	4	2.7	18	4.5

FREQUENCY OF NO EDGE TOUCHED BY SPECIES AND GENDER (more than 3 pictures)

Species	Female	Male
Human	60%	37.5%
Chimpanzee	33.3%	22.2%**
Gorilla	n/a	26.8%
Orang utan	27.3%	49.2%

** second level. Chimpanzee males touch one edge more frequently than they touch no edge.

CHART A
ROCK ART

No. of colours	No. of pictures	Overlap	Colour List
1 colour	12	Y = 17	Red 18
2 colours	9	N = 8	Black 13
3 colours	4		Yellow 6
1 petroglyph			White 3
			Brown 2



DIAGRAM 1 - PATTERN TYPE

Line Type	Line Orientation (single or multiple lines)			
	1	H	V	D
<u>Line</u> (does not change direction)				
<u>Arc/Curved Line</u> (open line that changes direction <30°)				
<u>Crossing Lines</u> (two approximately orthogonal lines)				
<u>Connected Lines</u> (two or more connected line segments)				
<u>Open Roving Lines</u> (curved, extended line not doubling over itself)				
<u>Closed Roving Line</u> (curved, extended line doubling over itself)				
<u>Dot/Spot</u> (e.g., thumb print, tongue touch)				
<u>Closed Line</u> (circular or otherwise, ending approximately where it began)				
<u>Smear</u> (non-directional amorphous blob)				

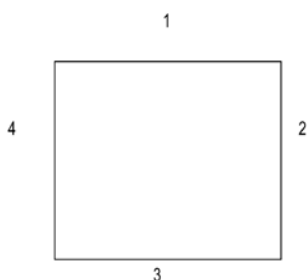
DIAGRAM 2 - EDGES TOUCHED

**Edges Touched by Gender and Species,
in Descending Order**

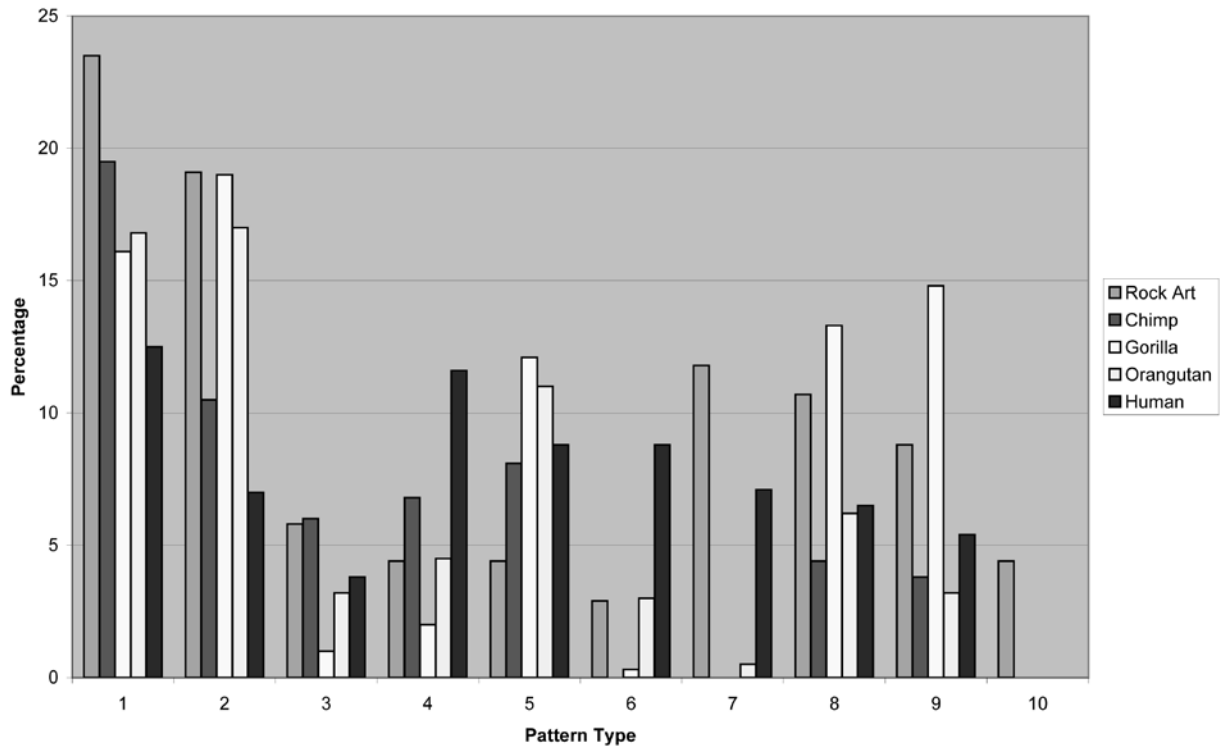
	Female	Male
Human	0 (60%), 1*3*4, 2	0 (37.5%), 3*4, 2, 1
Chimpanzee	0 (33.3%), 1, 3, 2, 4	234, 0 (22.2%), 1234
Gorilla	N/A ¹	0 (26.8%), 3, 13
Orangutan	0 (27.2%), 3, 1, 4, 2	0 (49.2%), 3, 13

¹ Cells of two or fewer.

Legend:

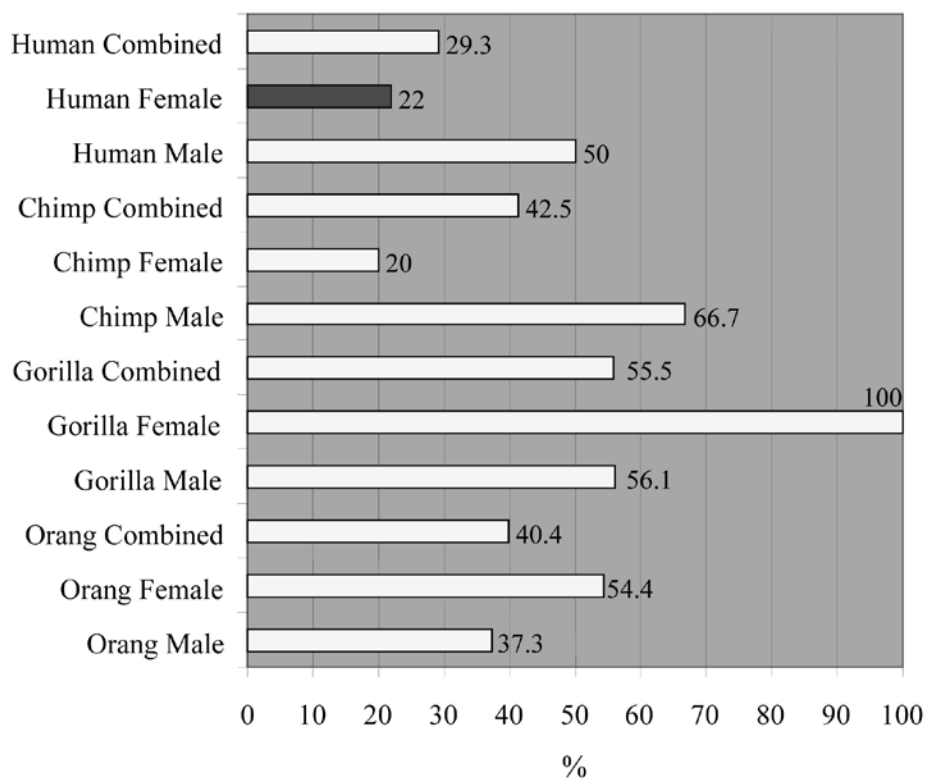


GRAPH 1 - Pattern by Species



Graph 2

First colour choice by species and gender





Grach 3

Second 1st colour choice by species and gender

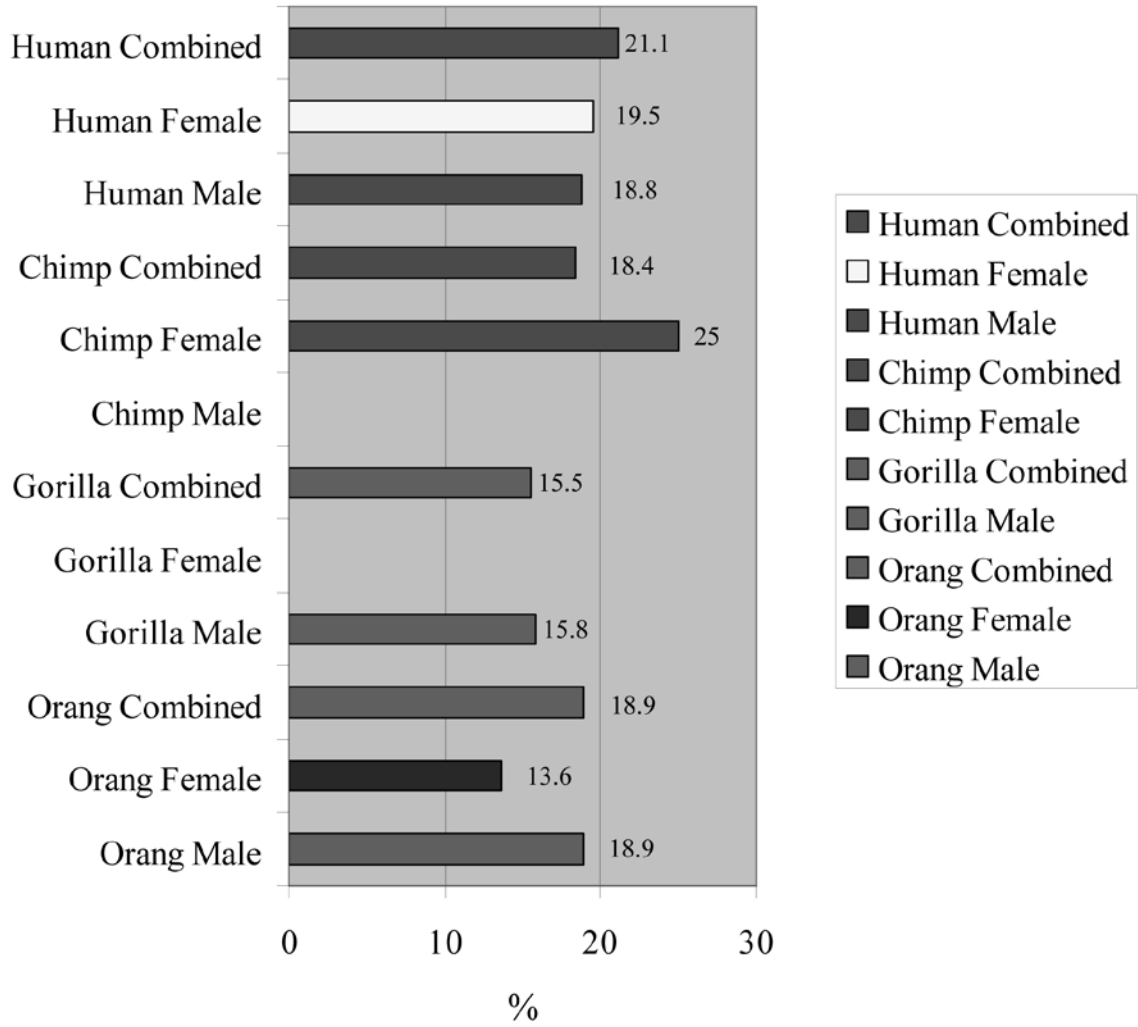




fig. 1



fig. 2



fig. 3



fig. 4

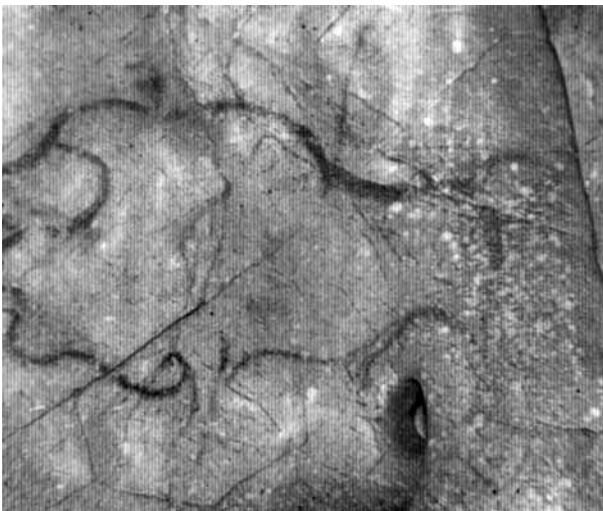


fig. 5



fig. 6

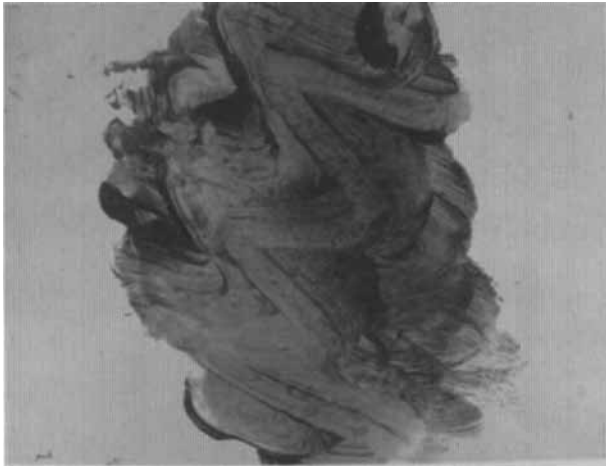


fig. 7



fig. 8



fig. 9

REFERENCES CITED

Balla, Giacomo. 1912. *Dynamics of a Dog on a Leash*. The Albright-Knox Gallery, Buffalo, NY.

Boysen, S.T. 2001. Personal communication.

Boysen, S.T., Bernston, G.G. and Prentice, J. 1987. 'Simian Scribbles': A Reappraisal of Drawing in the Chimpanzee (*Pan Troglodytes*). In: *Journal of Comparative Psychology*. CI/1:pp.82-89.

Duchamps, M. 1912. *Nude Descending a Staircase II*. Philadelphia Art Museum, Philadelphia, PA.

Fouts, D. 2007. P.C. Institute of Chimpanzee and Human Communication. University of Central Washington, Ellensburg, WA.

Schiller, P.H. 1951. Figural Preferences in the Drawings of a Chimpanzee. In: *Journal of Comparative Psychology*. XLIV:pp.101-111.

Schretlen, I. 2004. Research of Creative Expressions by Apes. Presented at Meetings of International Primatological Society, Turin, Italy.

Zeller, A.C. 1996. Cross-species Comparisons of Ape and Human Drawings. Presented at the AAA meetings, San Francisco, CA.

2006. Evolution of Aesthetics: The Prehuman Stage. Presented at the AAA meetings, San Jose, CA.