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Abstract

Previous studies have revealed that children increase the size of drawings of topics about which they feel positively and use their most preferred colours for colouring in these drawings, and decrease the size of topics about which they feel negatively and use their least preferred colours for colouring in these drawings. However, these previous findings have been obtained in studies employing drawing tasks where planning and production difficulties have been minimised by asking the children either to copy or to colour in an outline stimulus of a figure provided by the experimenter. The present experiment was designed to examine whether children also alter the use of size and colour in their drawings in response to emotional characterisations when they are not constrained by the presence of a model. Two hundred and fifty three children aged between 4 and 11 years were asked to produce drawings of a neutrally, a positively and a negatively characterised topic (either a man, a dog or a tree). It was found that the children consistently increased the size of the positively characterised figures, did not consistently decrease the size of the negatively characterised figures, used their most preferred colours for the positive figures, and used their least preferred colours for the negative figures. These findings are discussed in relation to the operation of an appetitive-defensive mechanism and pictorial conventions.

The effect of affective characterisations on the use of size and colour in drawings produced by children in the absence of a model

In the study of children's drawings, much attention has been given to the perceptual, cognitive and motor processes underlying children's drawing production, and the factors which influence the internal structure and visual realism of children's graphic depictions (e.g. Barrett, Beaumont & Jennett, 1985; Barrett & Bridson, 1983; Barrett & Eames, 1996; Barrett & Light, 1976; Bremner & Moore, 1984; Cox, 1981, 1985, 1992, 1993; Crook, 1984, 1985; Davis, 1983, 1985a, 1985b; Freeman, 1976, 1977, 1980, 1987; Gardner, 1980, 1982; Goodnow, 1977, 1978; Kellogg, 1969; Light & McEwan, 1987; Sitton & Light, 1992; Winner, 1982). However, some researchers have also explored whether the contents of children's drawings can be used as a reliable index of children's feelings concerning the objects which are depicted in their drawings (Burkitt, Barrett & Davis , 2003; Burkitt, Barrett & Davis, in press); Forrest & Thomas, 1991; Hammer, 1997; Joiner, Schmidt & Barnett, 1996; Jolley, 1995; Koppitz, 1968, 1969; Thomas, Chaigne & Fox, 1989; Thomas & Jolley, 1998). Situated within the latter tradition, the present experiment was designed to assess whether the size of the objects which are depicted in children's drawings, and the colours which are chosen for drawing those objects, are influenced by the affective characterisations which have been given to those objects.

This is an important issue to study because of its potential applications. Both size and colour in children's drawings have frequently been regarded by clinicians and other practitioners as having emotional significance (Alschuler & Hattwick, 1943, 1947; Arnheim, 1956, 1974; Aronsson & Andersson, 1996; Brick, 1944; Cleeve & Bradbury, 1992; Craddick, 1961, 1963; Di Leo, 1973; Golomb, 1992; Hammer, 1997; Hulse, 1951; Koppitz, 1968, 1969; Liebowitz, 1999; McNiff, 1992; Sechrest & Wallace, 1964; Solley & Haigh, 1957; Warren, 1993; Wilson, 1995; Winston, Kenyon, Stewardson & Lepine, 1995). However, most of the

claims to this effect have been based on professional observation and inference, rather than formal experimentation. This lack of formal experimentation is a serious omission, as children's drawings are often interpreted for personal meaning in clinical and educational settings (see, for example, Di Leo, 1973; Hammer, 1997), with interpretations of the emotional significance of the contents of children's drawings being made in such settings in the absence of an adequate research evidence base for those interpretations (which may have implications for the treatment of those children).

As far as the issue of size is concerned, previous authors have argued that children increase the size of attractive or positive topics (e.g. Aronsson & Andersson, 1996; Cleeve & Bradbury, 1992; Craddick, 1961; Di Leo, 1973; Hulse, 1951; Sechrest & Wallace, 1964; Solley & Haigh, 1957) and decrease the size of unattractive or threatening topics (Craddick, 1963; Koppitz, 1968, 1969; Wilson, 1995) in their drawings. However, Freeman (1976), Cox (1992), Jolley (1995) and Thomas and Jolley (1998) have all criticised the research upon which this conclusion has been based. In particular, they argue that much of this research fails to take into account the cognitive and perceptual-motor difficulties which children have in planning and producing drawings, typically relies upon *ad hoc* selections of drawings as evidence, fails to utilise proper experimental designs with appropriate controls to test the claims which are made concerning the effects of affective characterisations upon children's drawings, and omits any independent validation or measure of the affect which is supposed to be associated with a given drawing topic. As a result, they conclude that there is no real evidence to support the claim that children increase the size of attractive or positive topics and decrease the size of unattractive or negative topics.

Against this background of criticisms, however, Burkitt et al. (in press) conducted a study in which the cognitive and perceptual-motor demands upon the children were reduced to a minimum by asking them to copy predrawn outline shaded figures (of a man, a dog and a tree) from which all extraneous details had been eliminated (the aim being to minimise the

potential impact of planning and production factors, and to eliminate possible increases in size due to the anticipation of detail inclusion). These figures were given either positive ('nice', 'kind', 'pleasant', 'friendly'), negative ('nasty', 'horrible', 'mean', 'unfriendly') or emotionally neutral characterisations. After drawing production, the children's affect towards the figures was assessed independently (and confirmed as being in the intended direction) using an affect rating scale. A large sample was employed in the study (258 children aged between 4 and 11 years), as were rigorous experimental controls. All drawings were analysed using objective measurement techniques. It was found that the children drew the positively characterised topics larger than the neutrally characterised topics, and reduced the size of the negatively characterised topics relative to the neutral drawings. These patterns occurred at all ages and with all three drawing topics.

Interesting though these findings are in providing experimental evidence to support claims about size effects in children's drawings, the conclusions which can be drawn from this study are limited due to the fact that the drawings were produced under a set of highly circumscribed experimental conditions in which pre-drawn and very unusual models were provided for the children to copy. In order to establish whether these size effects occur more generally, it is essential to conduct further studies, in order to establish whether these effects still occur when more naturalistic models are involved, and when freehand drawings are produced in the absence of a model. The present study was designed to explore the latter possibility, i.e. whether the size effects identified by Burkitt et al. (in press) also occur when children produce drawings in the absence of a model.

In addition, the present study was designed to explore the possible effects of the affective characterisation of the drawn topic upon children's use of colour in their drawings. Many authors have argued that children's choice of colour is affected by the feelings which they hold towards the topic being drawn (e.g. Alschuler & Hattwick, 1943, 1947; Arnheim, 1956, 1974; Brick, 1944; Golomb, 1992; Hammer, 1997; Winston, Kenyon, Stewardson &

Lepine, 1995), with these claims often being voiced by clinicians and art therapists in relation to the observation and interpretation of colour use in patients' artwork as part of assessment and therapy (e.g. Dalley, 1984; Hammer, 1997; Liebowitz, 1999; McNiff, 1992; Warren, 1993). However, these claims are, once again, usually based upon professional observation rather than formal experimentation, and similar criticisms can again be made about the way in which these claims have been tested empirically in the past (i.e. systematic independent validation of the artist's feelings towards the topics drawn is usually not undertaken, rigorous experimental controls are typically not employed, and *ad hoc* selections of drawings are often used as the evidence base in this literature).

In the light of these limitations of the existing literature, Burkitt et al. (2003) conducted a more rigorous experimental study into children's use of colour in their drawings. A large sample was employed in the study (330 children aged between 4 and 11 years), as were appropriate experimental controls. The children completed two test sessions in counterbalanced order. In one session, the children rated and ranked ten colours in order of preference. In the other session, children completed three colouring tasks in which they had to colour in three outline figures (of either a man, a dog or a tree depending on which group they had been allocated to), which had been characterised as 'nice', 'nasty' or neutral. It was found that, at all ages and for all drawing topics, the children used their more preferred colours for the nice figures, their least preferred colours for the nasty figures, and colours rated intermediately for the neutral figures. It was also found that, in all age groups and for all topics, black tended to be the most frequently chosen colour for colouring in the drawings of the negatively characterised figures. By contrast, primary colours were predominantly selected for the neutral figure, while a wide range of mainly primary and secondary colours were chosen for colouring in the nice figure. These findings imply that children do systematically alter their use of colour during picture completion tasks in response to differential affective topic characterisations.

However, these results were once again obtained by Burkitt et al. under a set of highly circumscribed experimental conditions, this time involving a picture completion task. And consequently, questions may again be raised about the generalisability of these findings. It may well be the case that these effects of affective characterisation upon children's choice of colour do not occur when children have to produce their own freehand drawings in the absence of any model provided by the experimenter. The present study was designed to explore whether such effects do still occur under these less constrained conditions.

Thus, the study had two main goals. Firstly, it examined whether children would vary the size of affectively characterised topics in their drawings which were executed in the absence of a model. Specifically, the study explored whether children would increase the size of nice figures from baseline drawing size, and reduce the size of nasty figures from baseline drawing size, when no external model was made available to them in the drawing situation. Secondly, the study examined whether children would use differential colours for differentially characterised topics when they had to produce those drawings in the absence of an external model. On the basis of the findings by Burkitt et al. (2003), it was anticipated that the children would use their more preferred colours for the nice figures, their least preferred colours for the nasty figures, and colours which they rated intermediately for the neutral figures. It was also anticipated that black would be predominantly used for drawing negatively characterised figures.

The study utilised a number of the design features of the previous two studies by Burkitt et al. Control drawings were collected using a repeated measures design. Each child produced three drawings, a baseline control drawing first, followed by drawings of a positively and a negatively characterised topic administered in counterbalanced order. This was to control for possible order effects arising from the repeated-measures design and to enable within-subject comparison of potential scaling changes. It was judged that a repeated-measures design would give greater control over between-subject variation in the size used to

depict the characterised topics, and would reduce error variance. A five-point smiley-face Likert scale (see Figure 1) was used to assess the children's affect towards the depicted topics. Although this scale was unlikely to measure persistent affect over time, or to provide information about the children's underlying emotional attitudes toward the topics, it was judged that it would at least provide independent evidence as to whether the children did or did not rate the affectively characterised topics differently, and in the intended directions.

Each drawing was completed on separate sheets of paper, to control for potential production and planning difficulties. Three different groups of children drew three different topics (a man, a dog and a tree). This manipulation of model was included to assess the generalisability of the findings concerning the use of size and colour. Size itself was measured in three different ways, in terms of figure surface area, figure height and figure width.

In order to explore developmental trends, a large age range was employed: 4 to 11 year olds. Importantly, a large sample of children was used (N = 253). The number of children in each experimental group was above the minimum number (N = 20) needed to detect a medium effect size (Faul & Erdfelder, 1992). Finally, drawing ability was measured to assess whether the allocation of participants to cells in the design was at all biased by this variable.

Method

Participants

The participants were 253 children (129 boys, 124 girls) selected from mainstream primary schools in the county of Surrey, UK. They were selected randomly from school class lists. Firstly, three age groups were formed on the basis of year of schooling (youngest group: Reception, Years 1 and 2; middle group: Years 3 and 4; oldest group: Years 5 and 6). Children within each age group were assigned randomly to one of three experimental

conditions involving the drawing of one of the following topics: either a man (N = 84), a dog (N = 85), or a tree (N = 84). Full details of the sample are shown in Table 1. Within each subgroup, the children were further randomly divided into two for the order of task administration, with half the children receiving the nice instructions first, and the other half receiving the nasty instructions first.

INSERT TABLE 1 ABOUT HERE

Materials

Ten individual laminated colour cards shaded using Crayola crayons were used in Session 1 (red, orange, yellow, green, blue, purple, pink, white, brown and black), and the 10 coloured crayons themselves were provided for use by the children in Session 2. A five-point smiley-face Likert scale (showing faces with very unhappy, unhappy, neither unhappy nor happy, happy, and very happy expressions: see Figure 1) was used to gather affect ratings towards each individual colour in Session 1, and to gather affect ratings towards the affectively characterised drawings in Session 2. The drawings were produced on sheets of plain white A4 size paper using a lead pencil and then coloured in using the crayons.

INSERT FIGURE 1 ABOUT HERE

Procedure

Children were seen individually in a quiet area of their school. All children completed the following two test sessions administered in counterbalanced order on consecutive days.

Session 1

Children were shown the ten colour cards one at a time, in a different randomised order for each individual child. There was just the one colour shown on each card (either red, orange, yellow, green, blue, purple, pink, white, brown or black). As each colour was presented, they were asked to rate how they felt about that colour, using the Likert scale. Responses were scored between 1 and 5, where 1 = “very unhappy” and 5 = “very happy”. The instructions were as follows: *“I would like to find out how you feel about this colour.*

What I'd like you to do is point to the face to show how you feel about the colour. Here are the faces that you are going to be looking at (pointing to each face). The first one is a very unhappy face; the next one is quite an unhappy face; the middle one is neither happy nor unhappy. The fourth face is quite a happy face and the last one is a very happy face. When you answer my question, I'd like you to point to the face that describes how you feel about the colour. OK?" The instructions were repeated in full if the child indicated that they had not understood. Few children required additional prompting.

Session 2

During this session, all children produced three drawings of either a man, a dog or a tree. Each child produced the baseline model first, and then produced the positively and the negatively characterised drawings in counterbalanced order. The same colour crayons that had been used to prepare the materials in session 1 were provided for the children to use in this task. Each drawing was removed before presentation of the subsequent drawing task.

Baseline drawing task

The children were given a sheet of A4 paper, and the following instructions were used for the baseline drawing task. The children drawing the man received the following instructions: *"I'd like you to draw a man. Use the pencil to draw him, and use just one of these colours to colour him in. Draw the whole man as well as you can and colour him in as well as you can".* For the children drawing the dog, the instructions were as follows: *"I'd like you to draw a dog. Use the pencil to draw it, and use just one of these colours to colour it in. Draw the whole dog as well as you can and colour it in as well as you can".* The children drawing the tree were instructed as follows: *"I'd like you to draw a tree. Use the pencil to draw it, and use just one of these colours to colour it in. Draw the whole tree as well as you can and colour it in as well as you can".*

The drawing was left in place, and children were asked to rate their affect towards the subject of the drawing using the five-point Likert scale. The same instructions were used as

before, but with the modification that children were asked to rate how they felt about the man, the dog or the tree (rather than about the colour).

The children then produced two further drawings, of the two affectively characterised topics, in a counterbalanced order.

Nice drawing task

The preceding drawing was removed and the children were given a new sheet of A4 paper. The group drawing the man were instructed as follows: *"Now, think of a man who is a very kind nice man, and who is very pleasant and friendly to everyone. Draw the man, remembering what a nice person he is. Use the pencil to draw him, and just one of these colours to colour him in. Draw the whole man as well as you can and colour him in as well as you can"*. Children drawing the dog were given the following instructions: *"Now, think of a dog which is a very nice, kind dog, and which is very pleasant and friendly with everyone. Draw the dog, remembering what a nice dog it is. Use the pencil to draw it, and just one of these colours to colour it in. Draw the whole dog as well as you can and colour it in as well as you can"*. The children drawing trees were instructed as follows: *"Now, think of a tree that is a very nice lovely tree which everyone likes looking at and which is very pleasant. Draw the tree, remembering what a nice tree it is. Use the pencil to draw it, and just one of these colours to colour it in. Draw the whole tree as well as you can and colour it in as well as you can."* Immediately after the drawing task, the Likert scale was used once again in exactly the same way as before to measure the children's affect towards the topic which they had just drawn.

Nasty drawing task

The preceding drawing was removed and the children were given a new sheet of A4 paper. The group drawing the man were given the following instructions: *"Now, think of a man who is a very nasty horrible man who is very mean and unfriendly to everyone. Draw the man, remembering what a nasty man he is. Use the lead pencil to draw him, and just one of these*

colours to colour him in. Draw the whole man as well as you can and colour him in as well as you can". Children drawing the dog were instructed as follows: *"Now, think of a dog which is a very nasty horrible dog, and which is very unfriendly and barks at everyone. Draw the dog, remembering what a nasty dog it is. Use the lead pencil to draw it, and just one of these colours to colour it in. Draw the whole dog as well as you can and colour it in as well as you can".* Children drawing the tree were instructed as follows: *"Now, think of a tree which is very nasty and horrible, and which everyone hates looking at and which is very unpleasant. Draw the tree, remembering what a nasty tree it is. Use the lead pencil to draw it, and just one of these colours to colour it in. Draw the whole tree as well as you can and colour it in as well as you can".* Immediately after this drawing task, the Likert scale was used once again to measure the children's affect towards the topic which they had just drawn.

Drawing ability

During the period of testing, class teachers were asked to rate each class member's drawing ability by means of the following written instructions: *"Thinking of a typical Year {year group of child}, please rate {child's name} drawing ability on the following scale: poor (1), below average (2), average (3), above average (4), good (5).*

Measurements

The height of each drawing was measured as the vertical distance from the highest to the lowest extremity of the figure. Width was measured as the horizontal distance between the furthest left and furthest right extremities of the figure. Surface area was measured using a grid of 0.5 cm. squares. Squares with over 50% covered were counted, and squares with less than 50% covered were excluded. A second rater measured the surface area of 20% of the drawings from each age group, and a 93% inter-judge reliability to the nearest cm^2 was obtained. Surface area measurements of the drawings under contention were recounted by both judges until consensus was obtained and were included in the analyses.

Results

All children successfully completed the range of tasks. Due to the lack of homogeneity of variance, and the presence of skewed distributions in some of the cells of the design, the surface area, height and width measurements were transformed using a LOG 10 transformation prior to analysis. The data were screened for possible effects of the order of administration of the test sessions, and of the order of presentation of the characterised drawing tasks. No effects were found. These factors were thus excluded from further analyses. Effect sizes and observed power are reported for the size variables as it is possible that previous conflicting results in this field may be due to the lack of power in the methodologies which have been used (Burkitt et al., in press a).

Surface area

The surface area measurements from the three drawing types (baseline, nice and nasty) were submitted to a 3 (age group) x 3 (condition) x 3 (drawing type) three-way mixed ANOVA, with drawing type entered as a repeated measure, and the other two factors entered as independent measures. A main effect was found for drawing type ($F(2, 488) = 18.64$, $p<0.001$), with a medium effect size and high observed power (partial $\eta^2 = 0.07$, $P = 1.00$). The means are shown in Table 2. *Post hoc* paired t-tests showed that the nice drawings were significantly larger than the baseline and nasty drawings, at the 0.05 level; however, there was no difference between the baseline and nasty drawings. A main effect was also found for condition ($F(1, 244) = 27.63$, $p<0.001$). The effect size was small (partial $\eta^2 = 0.03$) with high observed power ($P = 1.00$). These means are also displayed in Table 2. *Post hoc* Scheffe ($p<0.05$) analysis showed drawings of men and trees to have a significantly larger surface area than drawings of dogs.

INSERT TABLE 2 ABOUT HERE

An interaction effect between drawing type and condition was also found ($F(4, 488) = 8.12$, $p<0.001$). The effect size was medium with high observed power (partial $\eta^2 = 0.06$, $P =$

1.00). Table 2 displays the means relating to this effect. *Post hoc* Scheffe ($p<0.05$) testing revealed that men and trees were drawn larger than dogs for all three types of drawings, and trees were drawn larger than men in the baseline drawings. *Post hoc* paired t-tests ($p<0.05$) on the drawing types for each condition revealed that both nice and nasty men and dogs were increased in size from baseline drawing size, that nice trees were larger than nasty trees, and that nasty trees were reduced in size from baseline trees.

An interaction effect was found between drawing type and age group ($F(2, 488) = 3.74$, $p<0.05$). This was a relatively small effect with reasonably high observed power (partial $\eta^2 = 0.03$, $P = 0.89$). *Post hoc* paired t-tests ($p<0.05$) showed that only the youngest and middle age groups increased the size of the nice drawings (youngest, transformed scores: $M = 2.12$, $SD = 0.53$, untransformed scores: $M = 65.49$, $SD = 103.70$; middle, transformed scores: $M = 2.02$, $SD = 0.52$, untransformed scores: $M = 53.06$, $SD = 70.78$) relative to the baseline drawing size (youngest, transformed scores: $M = 1.86$, $SD = 0.54$; untransformed scores: $M = 45.80$, $SD = 119.60$; middle, transformed scores: $M = 1.85$, $SD = 0.53$, untransformed scores: $M = 38.86$, $SD = 63.12$). There were no further main or interaction effects on surface area.

The frequency with which children either increased or decreased the surface area of characterised drawings from that of the baseline drawing was calculated. 71% ($N = 179$) of the children produced larger nice than baseline drawings, and 45% ($N = 112$) of the children reduced the size of their nasty drawings relative to their baseline drawings.

Height

Height measurements from the three drawing tasks were submitted to a 3 (age group) x 3 (condition) x 3 (drawing type) three-way mixed ANOVA, with drawing type entered as the repeated measure and the two remaining variables entered as independent factors. A main effect was found for drawing type ($F(2, 488) = 13.70$, $p<0.001$), showing a relatively small effect size with high observed power (partial $\eta^2 = 0.04$, $P = 1.00$).

INSERT TABLE 3 ABOUT HERE

Table 3 displays the means. *Post hoc* paired t-tests revealed that the nice drawings were significantly taller than both the baseline and nasty drawings at the 0.05 level.

A second main effect was found for condition ($F(2, 235) = 47.45$, $p<0.01$), showing a small effect size with high observed power (partial $\eta^2 = 0.04$, $P = 1.00$). *Post hoc* Scheffe ($p<0.05$) tests showed men (transformed scores: $M = 1.04$, $SD = 0.19$, untransformed scores: $M = 12.52$, $SD = 5.27$) and trees (transformed scores: $M = 1.04$, $SD = 0.25$; untransformed scores: $M = 13.57$, $SD = 6.45$) to be significantly taller than the dogs (transformed scores: $M = 0.69$, $SD = 0.21$; untransformed scores: $M = 6.17$, $SD = 4.50$) at the 0.05 level.

An interaction effect was found between drawing type and age group ($F(4, 488) = 3.84$, $p<0.05$). The effect size was small with high observed power (partial $\eta^2 = 0.03$, $P = 0.90$). The means are displayed in Table 3. *Post hoc* paired t-tests ($p<0.05$) located the interaction. Whilst nice drawings were drawn taller than baseline drawings by all the age groups, only the oldest group produced taller nasty drawings relative to baseline as well. No additional main or interaction effects were found for drawing height.

The frequency of children's tendency to increase the height of the positive drawings was calculated, as was their tendency to decrease the size of negative drawings relative to baseline. 66% ($N = 166$) of the children produced taller nice than baseline drawings, and 42% ($N = 107$) of the children reduced the height of their nasty drawings relative to their baseline drawings.

Width

Width data from each drawing type were submitted to a 3 (age group) x 3 (condition) x 3 (drawing type) three-way mixed ANOVA, with drawing type entered as a repeated measure, and age group and condition entered as independent factors. A main effect was found for drawing type ($F (2, 488) = 19.23$, $p<0.001$), revealing medium size effect with high power (partial $\eta^2 = 0.07$, $P = 1.00$). *Post hoc* paired t-tests showed that the nice drawings were wider than both the baseline and nasty drawings, and that the nasty drawings were wider

than the baseline drawings at the 0.05 level. Table 4 shows mean width for each drawing type.

INSERT TABLES 4 AND 5 ABOUT HERE

An interaction effect was found between drawing type and condition (F (4, 488) = 2.80, $p<0.05$). The effect was small, with relatively high power (partial $\eta^2 = 0.02$, P = 0.77). The relevant means are displayed in Table 4. *Post hoc* paired t-tests revealed that children in all conditions drew the nice version wider than the baseline version, whilst only in the tree condition were the nice drawings wider than the nasty drawings. Children drawing men and dogs also produced wider nasty drawings relative to baseline.

A main effect was also found for age group (F (2, 244) = 3.82, $p<0.05$). This effect was small with medium observed power (partial $\eta^2 =0.03$, $P = 0.70$). *Post hoc* Scheffe ($p<0.05$) analysis on the means presented in Table 5 showed that the children in the oldest group produced wider drawings overall than children in the middle age group. An interaction effect between drawing type and age group ($F(4, 488) = 6.71$, $p<0.001$) with a small size and high observed power (partial $\eta^2 = 0.05$, $P = 0.99$) qualified this main effect. *Post hoc* paired t-tests ($p<0.05$) showed that whilst all age groups produced wider nice than baseline drawings, the middle and oldest age groups also drew wider nasty versions relative to baseline. *Post hoc* Scheffe analysis ($p<0.05$) also showed that the youngest children made wider baseline and nice drawings than the middle age group, while the oldest group produced wider baseline drawings than the middle age group and wider nasty drawings than the youngest age group. No further effects for width were found.

The frequency with which children either increased or decreased the width of the affectively characterised drawings from the baseline drawing size was calculated. 66% (N = 166) of the children produced taller nice than baseline drawings, and 40% (N = 102) of the children reduced the height of their nasty drawings relative to their baseline drawings.

Affect ratings towards colours chosen for each drawing type

Mean affect ratings towards each individual colour (as measured in Session 1 using the Likert scale) were first calculated. The results are shown in Table 6. The children tended to prefer primary colours, followed by secondary colours, and liked the achromatic range and brown the least.

INSERT TABLE 6 ABOUT HERE

In order to assess whether children exhibited different affect towards the colours they had used to colour in the three differently characterised drawing topics, the data from the affect ratings for the colours used for each drawing type in Session 2 were analysed using a 3 (age group) x 3 (condition) x 3 (drawing type) three-way mixed ANOVA, with drawing type entered as the repeated measure. A main effect of drawing type was found ($F(2, 448) = 201.33$, $p<0.001$). *Post hoc* paired t-tests ($p<0.05$) showed that children had given more positive ratings towards the colours they had used for the nice drawings ($M = 4.24$, $SD = 1.20$) than for both the baseline ($M = 3.37$, $SD = 1.36$) and the nasty ($M = 2.06$, $SD = 1.30$) drawings. They had also given significantly more positive ratings towards the colours chosen for the baseline drawings than for the nasty drawings. No other effects on affect towards drawing colour choice were found.

The frequency of children's tendency to choose a colour they liked more for their nice drawings compared to their baseline drawings was calculated, as was the frequency to choose a less liked colour for their nasty drawings compared to their baseline drawings. 53% ($N = 134$) of the children chose a colour they liked more than their baseline colour choice for their drawings of positively characterised topics, whilst 68% ($N = 160$) of the children chose to complete their nasty drawings with a colour they liked less than the one they used for the baseline drawings.

The particular colours chosen for the baseline, nice and nasty drawings

Frequency counts of the specific colours which were used for the three drawing types (baseline, nice and nasty) were made for each condition individually. The data were analysed

using correspondence analysis, in order to explore the specific colours which had been used for the different drawings. Correspondence analysis (Hammond, 1988, 1993) uses well-established geometric principles to provide a pictorial representation of the relationship between categories of response and groups of individuals. It permits a multi-dimensional analysis of categorical data by providing a plot in which the geometric distance between the groups and the types of response gives a direct measure of the relative degree of association between the groups and the response types. This graphical representation reveals those colour choices which are most closely associated with each group (be it age, condition or drawing type) and which therefore best discriminate the behaviour of the children in each subgroup.

A series of individual correspondence analyses was run. Colour choices for each drawing type were compared individually and simultaneously across age groups and condition. Colours with a response frequency count of less than 5 were not included in the sequence of analyses in order to avoid the results being biased by these low frequency responses (Hammond, 1988). The outcomes for the three conditions individually, irrespective of age, were as follows.

The children's colour choices for drawing the men were analysed. Two significant dimensions were found ($\chi^2(11) = 55.23$, $\underline{p}<0.001$; $\chi^2(9) = 26.24$, $\underline{p}<0.01$) as shown in Figure 2. Purple and pink were more closely associated with the baseline task than with the other two tasks; yellow, green and blue were more closely associated with the nice task than with the baseline and nasty tasks; and white, brown and black were more closely associated with the nasty task.

INSERT FIGURES (PLOTS) 2, 3 AND 4 ABOUT HERE

Colour choices for the children drawing dogs were also analysed using correspondence analysis. Two significant dimensions were found ($\chi^2(11) = 24.88$, $\underline{p}<0.05$; $\chi^2(9) = 20.48$, $\underline{p}<0.05$). As shown in Figure 3, white and brown were more closely associated with the baseline task than with the nice and nasty tasks; red, orange, yellow, blue and purple

were more closely associated with the nice than with the baseline and nasty tasks; and green, black and pink were more closely associated with the nasty task than with the nice and baseline tasks.

The correspondence analysis of children's responses in the tree condition for each drawing type yielded two significant dimensions ($\chi^2(10) = 107.87$, $p<0.001$; $\chi^2(8) = 27.22$, $p<0.001$). As shown in Figure 4, green was more closely associated with the baseline task than with the nice or nasty tasks; red, orange, yellow, blue and purple were more closely associated with the nice task than with the baseline and nasty tasks; and pink, brown and black were more closely associated with the nasty task.

Correspondence analyses were then run for each condition group broken down by age group separately. There was some variation in colour choice for each drawing type between the age groups drawing the men from those shown in Figure 2. For the youngest age group, red, yellow, blue, purple and pink were used more for the baseline and nice tasks than for the nasty task, and white was not associated with the nasty task. The middle age group's responses were also less varied, in that only red and purple were more closely associated with the baseline task than with the nice and nasty tasks, and only black was more closely associated with the nasty task than with the baseline and nice tasks. No significant dimensions for the oldest group drawing the men were found.

For the groups drawing the dog, a significant dimension was only found for the youngest group. Their colour use showed a more restricted pattern than the one seen in Figure 3. Blue and red were more closely associated with the baseline and nice tasks, and black was more closely associated with the nasty task than with the nice and baseline tasks.

Analysis of the responses of the youngest group drawing the trees showed that purple was also more closely associated with the baseline task than the other two tasks, that red and blue were more closely associated with the nice task than with the baseline and nasty tasks, and that brown and black were more closely associated with the nasty task than with the

baseline and nice tasks. Responses from the middle age group differed from those illustrated in Figure 4 in that a narrower range (red, yellow and purple) was more closely associated with the nice task than with the baseline and nasty tasks. No significant dimensions emerged for the oldest group drawing trees.

Affect ratings toward baseline, nice and nasty topics

In order to assess whether children did indeed exhibit different affect towards the three topics which they had drawn, the data from the Likert scale for each drawing type (baseline, nice and nasty) from Session 2 were submitted to a 3 (age group) x 3 (condition) x 3 (drawing type) three-way mixed ANOVA, with drawing type entered as the repeated measure. A main effect for drawing type was found ($F(2, 488) = 1556.57$, $p<0.01$). *Post hoc* paired t-tests ($p<0.05$) showed that more positive ratings were given to the nice topics ($M= 4.71$, $SD=0.55$) than to both the baseline ($M=3.07$, $SD=0.90$) and the nasty topics ($M=1.33$, $SD=0.57$). More positive ratings were also given towards the baseline topic than the nasty drawing topic ($p<0.05$). No other differences between these affect ratings were found.

Drawing ability

Finally, the drawing ability data provided by the class teachers were analysed using a 3 (age group) x 3 (condition) two-way simple factorial ANOVA. No effects were found, indicating that allocation of participants to cells in the experimental design was not biased in terms of the children's drawing ability.

Discussion

The changes in size as a function of the affective characterisation of the topic being drawn

In line with the findings reported by Burkitt et al. (in press), this study found that the children increased the size of their drawings of positively characterised topics. However, a tendency to reduce the size of drawings of topics which had been negatively characterised was not exhibited consistently in the present study. Instead, there was some evidence of topic specific effects. The most notable such effect was that the children only reduced the size of

negatively characterised trees relative to baseline, and did not reduce the size of negatively characterised men or dogs. Also unlike the findings of Burkitt et al., age effects were found, in that whilst all children increased the height and width of nice drawings from the baseline size, the oldest children, unlike those in the youngest and middle age groups, did not increase the surface area of nice drawings, and also produced nasty versions larger than baseline. Overall, it would seem that while some of the size effects found in the previous study (in which the children were asked to copy a shaded outline figure rather than to produce a freehand drawing as in the present study) do generalise to drawings tasks in which no model is provided, other size effects do not.

Other topic-specific effects on figure size were also found in this study. Men and trees were drawn taller and larger than dogs. This could simply be interpreted as reflecting children's real life perception of the topics. Consistent with this hypothesis, children's affect ratings showed that the drawings did not represent topics of different affective significance to the children. Furthermore, the content analysis of the drawings revealed that the men and the trees did not contain more details than the drawings of the dogs.

One suggestion for consideration in future studies is that the children may have been drawing from different cues when drawing animate topics (men and dogs) compared with non-animate topics. It could be the case that the children were drawing on their real life experiences and memories of the animate topics. This possibility is difficult to ascertain from the present research design. It could however be argued that, if children were cued from experience differently between animate and non-animate topics, then they might feel more positively towards the positive men and dogs than the positive trees, and more negatively towards the negative men and dogs than the negative trees, as a result of their positive and negative interactive experiences. The affect ratings given for each topic did not support this possibility. However, future research could examine the differential memory cues that children may use when representing animate versus non-animate topics, and whether children

draw more on real life memories when depicting animate rather than inanimate topics. This research would need to employ adequate sample sizes and include independent measures of the children's affect towards the animate and inanimate topics, unlike research in the area that has uncovered contradictory findings (e.g. Thomas, Chaigne & Fox) regarding topic animacy. In addition, it might be argued that a tree represents an animate object, and future studies in this area could assess whether children did indeed regard the various topics as animate or inanimate.

It is interesting to speculate about why different age groups produced different patterns of size change and why some findings were topic specific. As Thomas and Jolley (1998) point out, the interpretation of size changes in children's drawings is a complex process, as a reduction or an increase in the size of a feature may be a positive sign in one child's drawings and a negative sign in the next child's drawing of the same topic. However, the existing literature (e.g. Jolley, 1995; Fox & Thomas, 1990; Thomas et al., 1989) provides two theoretical possibilities as to why drawing size may be affected by topic characterisation. On the one hand, children may be responding using an acquired pictorial convention according to which larger figures represent nice characteristics and smaller figures represent nasty characteristics. On the other hand, children may be responding using an appetitive mechanism which serves to increase the size of nice topics in order to achieve psychological affinity with such topics, and a defensive mechanism which serves to decrease the size of nasty topics in order to reduce the perceived threat of the drawn figure and to increase psychological distance from such a figure.

The results obtained in the present study may be construed as fitting either interpretation. One difficulty with the pictorial convention explanation, however, stems from Jolley's (1995) finding that, during drawing perception tasks (as opposed to drawing production tasks), children identify small figures as nice characters and large pictures as nasty characters. This is the opposite pattern to that found in children's production of positively and

negatively characterised figures in their drawings. As it is unlikely that opposite pictorial conventions would be acquired for drawing perception and drawing production, the present findings are arguably more convincingly explained by the appetitive-defensive account.

However, this account is not especially persuasive when applied to the negatively characterised topics which were drawn in the present study. Indeed, inspection of the children's drawings of the trees revealed that the children had adopted different drawing styles for drawing nice and nasty trees: nice trees tended to be drawn as lollipop-type trees, whereas nasty trees tended to be drawn as withered, sparse, stick-type trees. Whilst the difference between these styles would not necessarily affect the height and width of the drawing, this difference would affect the surface areas of these drawings. The reduction in surface area of the nasty trees relative to baseline is therefore probably a result of the freedom given to children in a freehand drawing task to alter their drawing style in relation to a negative characterisation, whereas a positive characterisation may simply have conjured up the same image as a neutrally characterised tree. Unlike the previous study by Burkitt et al. (in press), the present data therefore do not support the idea that children reduce the size of negative or more threatening topics, casting some doubt on the interpretation based on a defensive mechanism.

Either explanation could also be used to explain why the older children did not increase the drawing size of positively characterised topics as consistently as the younger children. This finding could be interpreted as implying that whilst children learn a pictorial convention at an early age, with age they acquire new drawing strategies which override considerations of size. This idea is supported by the further finding that the oldest children also increased the height of the nasty drawings relative to baseline, probably as a result of utilising other strategies with which to express the character and their own attitude towards the topic. The data could, however, equally be interpreted as a result of an appetitive mechanism exerting a stronger influence on the drawings of younger children.

The literature on children's cognitive and artistic development shows that children do go through various phases of drawing development when progressing from non-representational to representational artwork (e.g. Cox, 1992, 1993; Golomb, 1992; Lowenfeld & Brittain, 1982). The literature would suggest that the drawings from the younger children should have been larger than those from the oldest age group, as typical drawing styles for young children (e.g from 4 year olds) differ for some topics from those used by older children (e.g. 9 year old). Younger children draw tadpole figures and lollipop tress (Cox, 1992; Goodnow, 1977), both of which could result in such drawings having a larger surface area than the more differentiated and realistic trees and human figures typically produced by children in later childhood. Although these broad stylistic differences were observed in the present study, they did not have any overall impact on drawing size; instead, older children produced larger drawings. Given the lack of developmental trends in this area of drawing production (Craddick, 1961, 1963; Sechrest & Wallace, 1964; Solley & Haigh, 1957; Thomas, Chaigne & Fox, 1989), it seems that the provision of affective characterisations of the topics does genuinely interact with the typical use of drawing strategies, at least as far as the drawing strategy of scaling is concerned.

It should be noted that the present pattern of results is unlikely to have been simply due to children's tendency to increase figure size in order to include details (Freeman, 1977, 1980). A content analysis of the children's drawings revealed that a greater number of additional details had been used in the nasty drawings than in the nice drawings overall, compared with the baseline figures. If detail inclusion were to be the crucial factor influencing size change in affectively characterised drawings, then the nasty figures should have been drawn larger than the nice figures. However, this was not the case.

The finding that there were no main or interaction effects of the order of presentation on the characterised drawings further strengthens the argument that the affective characterisations, rather than children's natural tendency to draw a second figure either larger

or smaller than an initial one (Hammer & Kaplan, 1964), influenced the size of the children's drawings. These effects cannot be viewed merely as an artefact of a repeated measure design.

As had been anticipated, the children rated topics which had received a positive topic characterisation most positively, followed by intermediate ratings for the neutrally characterised baseline topics, and the least positive ratings were given of the negatively characterised topics. Although not a measure of how the children were actually feeling during drawing production itself, this finding does nevertheless attest to the successful manipulation of differential affective significance through the task instructions.

Thus, this study provides additional evidence that children do indeed produce larger nice than nasty figures in their freehand drawings, and increase the size of nice figures from baseline figure size, even when they are allowed to use other strategies such as adding further details to their drawings. It seems that whether children are responding on the basis of an acquired pictorial convention, or on the basis of appetitive-affiliative mechanisms, the response is strong enough to override children's tendency to draw larger figures when they are permitted to include all the detail they wish. The findings are in line with researchers who maintain that topic significance can affect the size of children's drawings (Aronsson & Andersson, 1996; Burkitt et al., in press; Burns & Kaufman, 1972; Craddick, 1961, 1963; Cleeve & Bradbury, 1992; Fox & Thomas, 1990; Hulse, 1952; Sechrest & Wallace, 1964; Thomas, Chaigne & Fox, 1989), and suggest that size changes of positively characterised figures from baseline size are measurable and reasonably consistent. However, the findings of the present study also serve to cast some doubt on the generalisability of previous findings (Burkitt et al., in press a) that nasty or negative topics are consistently scaled down in size compared with baseline and nice/positive topics.

<u>The changes in colour as a function of the affective characterisation of the topic being drawn</u>

In line with previous findings (Burkitt et al., 2003), the children used different colours for the completion of differentially affectively characterised topics. The task instructions

were sufficient to restrict children to the choice of one colour for each drawing. The children's selections were related to their colour preferences. They used colours that they rated more positively for their positively characterised drawings, colours that they rated intermediately for their baseline drawings, and colours that they rated least positively for completion of the negatively characterised topics. Thus, previous findings concerning the use of colour did generalise to children's freehand drawings. This lends further support to the assertion that children's colour use is not fortuitous or incidental, and that even very young children can use colour symbolically in drawing production (cf. Alschuler & Hattwick, 1943, 1947; Golomb, 1992; Winston et al., 1995). These findings were unrelated to the children's age or to the particular topic being drawn.

In the case of the positively characterised drawings, it is possible that the children were again responding on the basis of an appetitive mechanism, given that the children tended to use their most liked colours for their drawings of these topics. However, the children's use of less liked colours for colouring in the negatively characterised figures is unlikely to be due to a defensive mechanism, as the use of these colours would arguably render these figures even more aversive than if they had been coloured in with more positively liked colours. Thus, whilst the use of reduced size might be construed as minimising the threat of a negative figure, we would suggest that the use of a disliked colour for a negative topic is much more likely to be a means of communicating dislike rather than as a means to reduce the threat of the depicted figure. The findings cannot be fully accounted for in terms of pictorial conventions: realism is emphasised in artistic learning in general, but the children's colour choices did not follow realistic colour choices in the main.

No effects of the order of test administration were found. Consequently, it cannot be argued that children were simply selecting different colours for their three drawings because they desired a change or believed that the experimenter required them to use a different colour for each task.

The specific colours that were used for the neutral, nice and nasty figures

Overall, the children chose green and purple for their baseline figures, red, blue and yellow for their nice figures, and white, black and brown for the nasty figures. A variety of colour choice was found between different topics and between the different age groups. For example, green was more prevalent in children's baseline drawings of trees than dogs. Such selection implies a role for realism in children's colour choice. However, as in the earlier study (Burkitt et al., 2003), with children's spontaneous drawings, black emerged as the colour that was most closely associated with the nasty figures, along with brown and white, and the oldest children's use of pink.

These findings therefore show that the colour effects identified by Burkitt et al. (2003) do indeed generalise to a freehand drawing task. Thus, primary colours were mainly selected for nice figures, secondary colours for baseline figures, and the achromatic range primarily selected for the nasty figures. The evidence also suggests that children may be selecting colours based on their own affective responses to colours. Thus, the colours selected for the different types of drawings reflected the children's own colour preferences, namely primary colours were most liked and used for the nice figures, secondary colours were given intermediate ratings and used for the baseline figures, and achromatic colours were rated most negatively and were used for the nasty figures. Thus, colour is used systematically in relation to the emotional character of the figure, and the use of colour in relation to emotional character can clearly override children's tendency to use realistic colours in freehand drawing tasks.

Implications for practitioners

This study provides evidence to support some of the claims that have been made by clinical and educational practitioners (e.g. Di Leo, 1973; Hammer, 1997; Koppitz, 1968), namely that children's use of size and colour in their drawings can be used as indices of how they feel about the topics which they have drawn. However, it is necessary to apply some

caution when considering the practical applications of these findings. Although this experiment did allow the children to produce freehand naturalistic drawings, the drawings were still produced under restricted conditions. For example, children were only permitted to use one colour for each drawing and were asked to draw topics that they might not necessarily consider as nice or nasty with the same emotional depth as real-world topics may elicit. Furthermore, the drawings were produced in response to specific instructions that might not be encountered outside this formal experimental setting. In order to establish the broader utility of these findings, it is therefore essential to conduct further studies to ascertain whether these effects of affective characterisations also occur: (a) when topics more relevant to the child's own life are being drawn (e.g. family members); (b) when drawings of naturally emotive topics are produced; and (c) when children from special (as opposed to mainstream) populations produce drawings.

That said, however, this study does suggest that the size and colour used for depicting an object in a drawing may indicate the affective significance of that object for the child. An examination of the frequencies with which the children in the present study altered the size and the colour of their drawings of positively and negatively characterised topics gives an approximate indication of what might broadly be expected of freehand drawings produced by children within the 4-11 year old age range. When topics have been given a positive characterisation, practitioners can typically expect children to produce taller, wider and larger drawings relative to their drawings of a neutral topic. They can also reasonably expect children to use a preferred colour for depicting a positively characterised topic. However, conclusions concerning the drawing of negatively characterised topics are rather less straightforward, as here the type of drawing task and the specific topic would appear to have a greater influence. When copying models that have been given a negative characterisation (as in the studies by Burkitt et al., in press a, in press b), practitioners can expect that the majority of the children will reduce the surface area and height of their drawings relative to a

neutral version. However, when children produce freehand drawings (i.e. in the absence of a model, as in the present study), children may not as consistently reduce the size of supposedly threatening topics, and may only do so with inanimate topics, such as trees. However, children can be expected to use one of their least favourite colours (most commonly black) for depicting topics with a negative characterisation.

Conclusions

This experiment has shown that children do indeed alter the size and the colour which is used to depict affectively characterised topics in their drawings. The findings of this study suggest that the majority of effects reported in previous studies are not necessarily an artefact of the methodological limitations noted by Freeman (1976), Cox (1992), Jolley (1995) and Thomas and Jolley (1998). While the precise nature of the mechanisms which are responsible for these effects remains elusive and must be a subject for future research, this experiment has provided unambiguous evidence that, contrary to the assertions of some recent researchers, size and colour changes in relation to affective characterisation do indeed occur, and that these phenomena require further investigation.

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Table 1: Mean ages and age range of children in each age group for each condition (in years and months)

Condition	*Age Group*			*Grand Means*
	Youngest (N=109)	*Middle (N=72)*	*Oldest (N=72)*	
Man (N=84)	N=36 M=5y11m Range=4y3m-7y6m	N=24 M=8y0m Range=7y-7m-8y11m	N=24 M=10y1m Range=9y0m-11y2m	M=8y0m Range=4y3m-11y2m
Dog (N=85)	N=37 Mean=6y0m Range=4y4m-7y6m	N=24 Mean=8y0m Range=7y7m-8y11m	N=24 Mean=10y2m Range=9y0m-11y1m	M=8y0m Range=4y4m-11y1m
Tree (N=84)	N=36 M=6y1m Range=4y3m-7y6m	N=24 M=8y0m Range=7y7m-8y10m	N=24 M=10y1m Range=9y0m-11y2m	M=8y1m Range=4y3m-11y2m
Grand Means	M=6y0m Range=4y3m-7y6m	M=8y0m Range=7y7m-8y11m	M=10y1m Range=9y0m-11y2m	M=8y0m Range=4y3m-11y2m

Table 2: Mean transformed surface area scores of each drawing type in each condition (untransformed means shown in bold)

	Condition			*Grand Means (N=253)*
Drawing Type	*Man (N=84)*	*Dog (N=85)*	*Tree (N=84)*	
Baseline	1.87 (SD=0.45) **34.20 (SD=58.31)**	1.60 (SD=0.43) **16.57 (SD=28.31)**	2.21 (SD=0.53) **89.87 (SD=149.33)**	1.89 (SD=0.53) **46.76 (SD=98.56)**
Nice	2.14 (SD=0.42) **57.32 (SD=77.21)**	1.80 (SD=0.47) **28.21 (SD=38.61)**	2.30 (SD=0.53) **98.18 (SD=129.82)**	2.08 (SD=0.52) **61.10 (SD=94.01)**
Nasty	2.04 (SD=0.53) **57.08 (SD=78.43)**	1.75 (SD=0.47) **23.90 (SD=30.13)**	1.99 (SD=0.58) **56.44 (SD=82.55)**	1.93 (SD=0.54) **45.72 (SD=69.39)**
Grand Means	2.02 (SD=0.39) **49.53 (SD=62.47)**	1.72 (SD=0.38) **22.90 (SD=23.30)**	2.17 (SD=0.45) **81.50 (SD=96.26)**	1.97 (SD=0.45) **51.20 (SD=71.38)**

Table 3: Mean transformed height scores of each drawing type for each age group (untransformed means are shown in bold)

	Age Group			*Grand Means N=253*
Drawing Type	*Youngest (N=109)*	*Middle (N=72)*	*Oldest (N=72)*	
Baseline	0.91 (SD=0.32) **10.17 (SD=6.71)**	0.82 (SD=0.31) **8.48 (SD=6.08)**	0.91 (SD=0.30) **10.40 (SD=7.24)**	0.88 (SD=0.31) **9.75 (SD=6.71)**
Nice	1.02 (SD=0.29) **13.19 (SD=10.04)**	0.92 (SD=0.32) **10.65 (SD=7.05)**	0.98 (SD=0.28) **11.65 (SD=7.37)**	0.98 (SD=0.31) **12.03 (SD=8.59)**
Nasty	0.87 (SD=0.38) **9.77 (SD=6.76)**	0.88 (SD=0.34) **10.16 (SD=7.70)**	0.98 (SD=0.29) **11.71 (SD=8.17)**	0.90 (SD=0.35) **10.43 (SD=7.47)**
Grand Means	0.93 (SD=0.28) **11.04 (SD=6.34)**	0.87 (SD=0.28) **9.76 (SD=6.05)**	0.96 (SD=0.26) **11.25 (SD=6.63**	0.92 (SD=0.28) **10.73 (SD=6.35)**

Table 4: Mean transformed width scores of each drawing type for each condition (untransformed means are shown in bold)

Drawing Type	*Condition*			*Grand Means (N=253)*
	Man (N=84)	*Dog (N=85)*	*Tree (N=84)*	
Baseline	0.70 (SD=0.25) **5.96 (SD=3.64)**	0.73 (SD=0.27) **6.33 (SD=3.44)**	0.80 (SD=0.27) **7.39 (SD=4.62)**	0.74 (SD=0.26) **6.56 (SD=3.96)**
Nice	0.86 (SD=0.23) **8.24 (SD=4.33)**	0.84 (SD=0.22) **7.82 (SD=3.58)**	0.85 (SD=0.28) **8.58 (SD=5.25)**	0.85 (SD=0.24) **8.21 (SD=4.43)**
Nasty	0.84 (SD=0.28) **8.33 (SD=5.00)**	0.80 (SD=0.26) **7.52 (SD=4.32)**	0.77 (SD=0.28) **7.11 (SD=4.57)**	0.80 (SD=0.28) **7.65 (SD=4.65)**
Grand Means	0.80 (SD=0.21) **7.51 (SD=3.75)**	0.79 (SD=0.20) **7.22 (SD=3.03)**	0.80 (SD=0.20) **7.69 (SD=3.43)**	0.80 (SD=0.20) **7.47 (SD=3.41)**

Table 5: Mean transformed width scores of each drawing type for each age group (untransformed means are shown in bold)

Drawing Type	*Age group*			*Grand Means (N=253)*
	Youngest (N=109)	*Middle (N=72)*	*Oldest (N=72)*	
Baseline	0.77 (SD=0.25) **6.90 (SD=4.12)**	0.66 (SD=0.27) **5.41 (SD=3.17)**	0.78 (SD=0.26) **7.18 (SD=4.25)**	0.74 (SD=0.26) **6.56 (SD=3.96)**
Nice	0.89 (SD=0.26) **9.19 (SD=4.85)**	0.79 (SD=0.23) **7.13 (SD=4.16)**	0.85 (SD=0.20) **7.82 (SD=3.69)**	0.85 (SD=0.24) **8.21 (SD=4.43)**
Nasty	0.75 (SD=0.30) **7.08 (SD=4.67)**	0.80 (SD=0.26) **7.41 (SD=4.58)**	0.88 (SD=0.24) **8.77 (SD=4.55)**	0.80 (SD=0.28) **7.65 (SD=4.65)**
Grand Means	0.81 (SD=0.21) **7.72 (SD=3.59)**	0.75 (SD=0.18) **6.65 (SD=2.93)**	0.84 (SD=0.20) **7.92 (SD=3.46)**	0.80 (SD=0.20) **7.47 (SD=3.41)**

Table 6: Mean affect rating towards the test colours in order of descending preference

Colour	*Mean affect rating (N=253)*
Blue	4.10 (SD=1.31)
Yellow	4.06 (SD=1.15)
Red	3.96 (SD=1.47)
Purple	3.64 (SD=3.60)
Orange	3.24 (SD=1.18)
Green	3.21 (SD=1.27)
Pink	2.91 (SD=1.78)
White	2.83 (SD=1.37)
Brown	2.14 (SD=1.16)
Black	1.92 (SD=1.18)

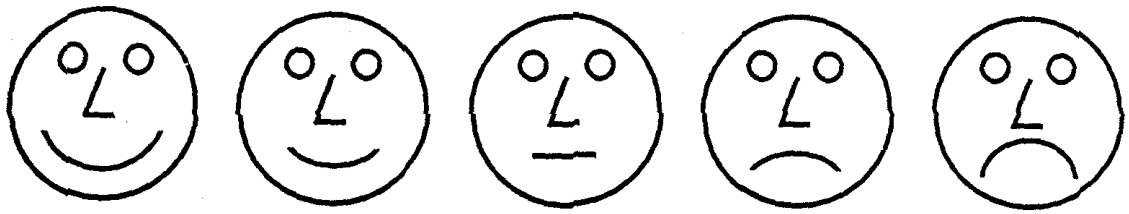

Figure 1: Likert scale used to measure children's affect towards the characterised stimuli and colour range

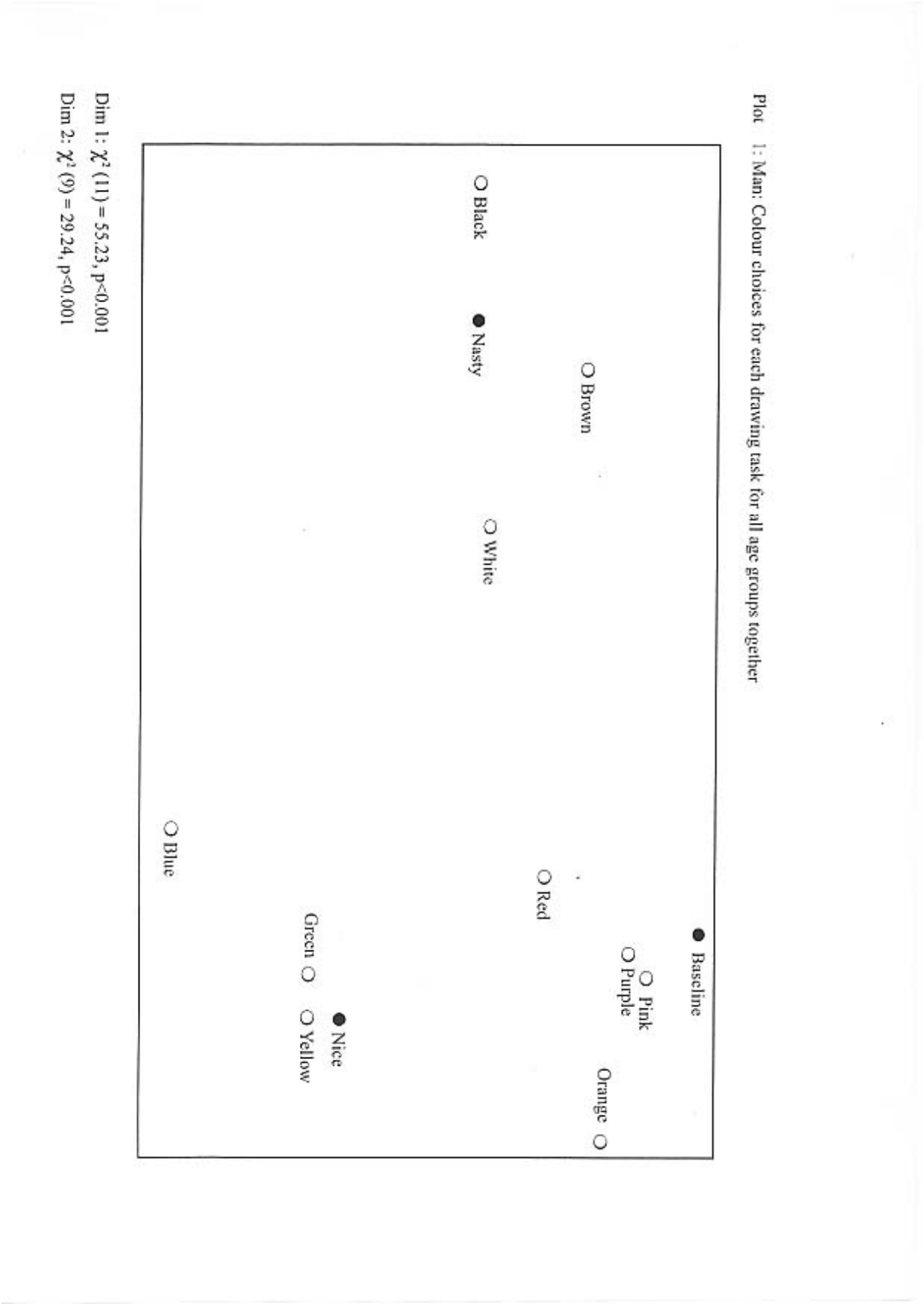

Figure 2: Plot 1: Man: Colour choices for each drawing task for all age groups together

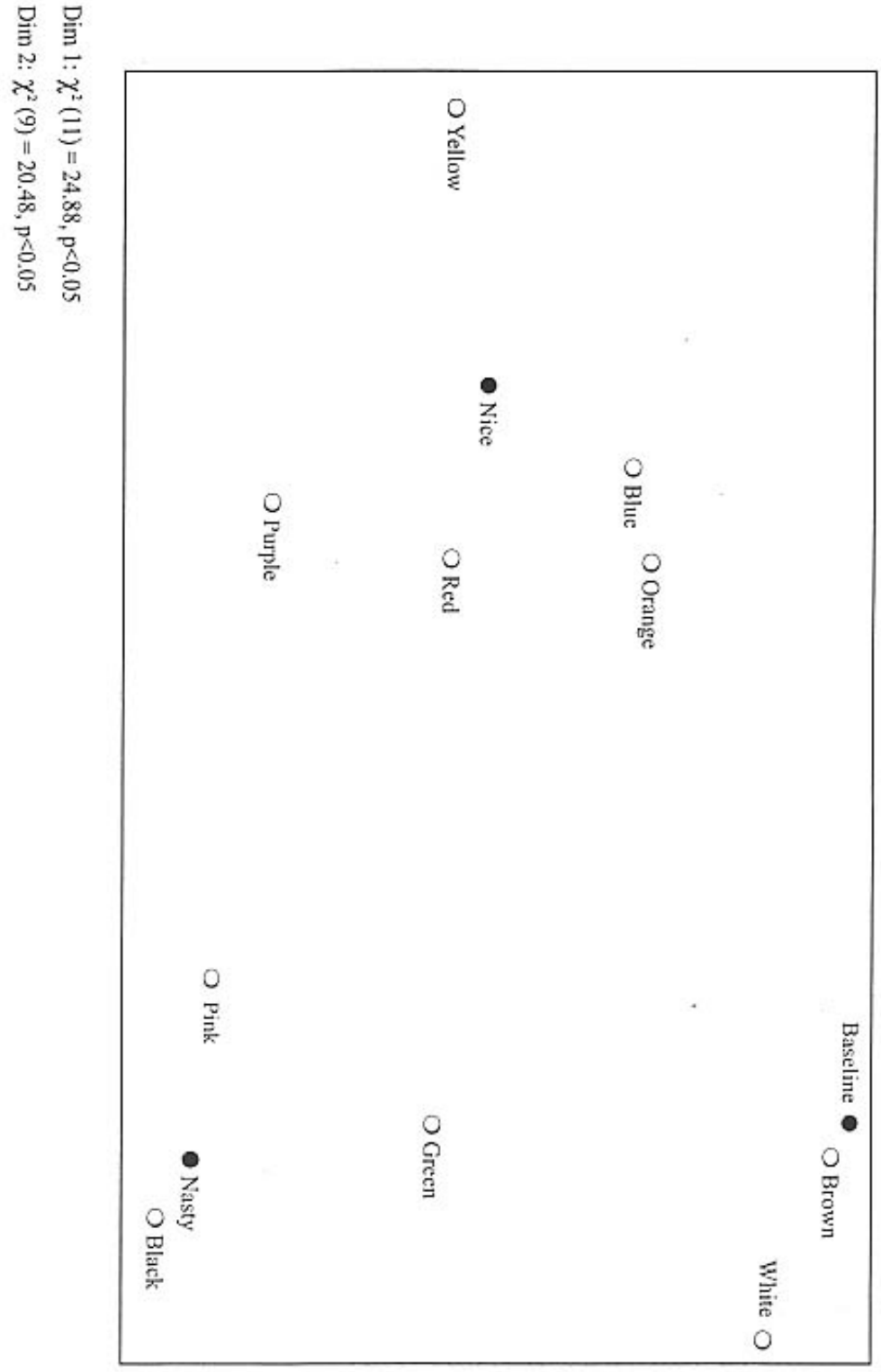

Figure 3: Plot 2: Dog: Colour choices for each drawing task for all age groups together

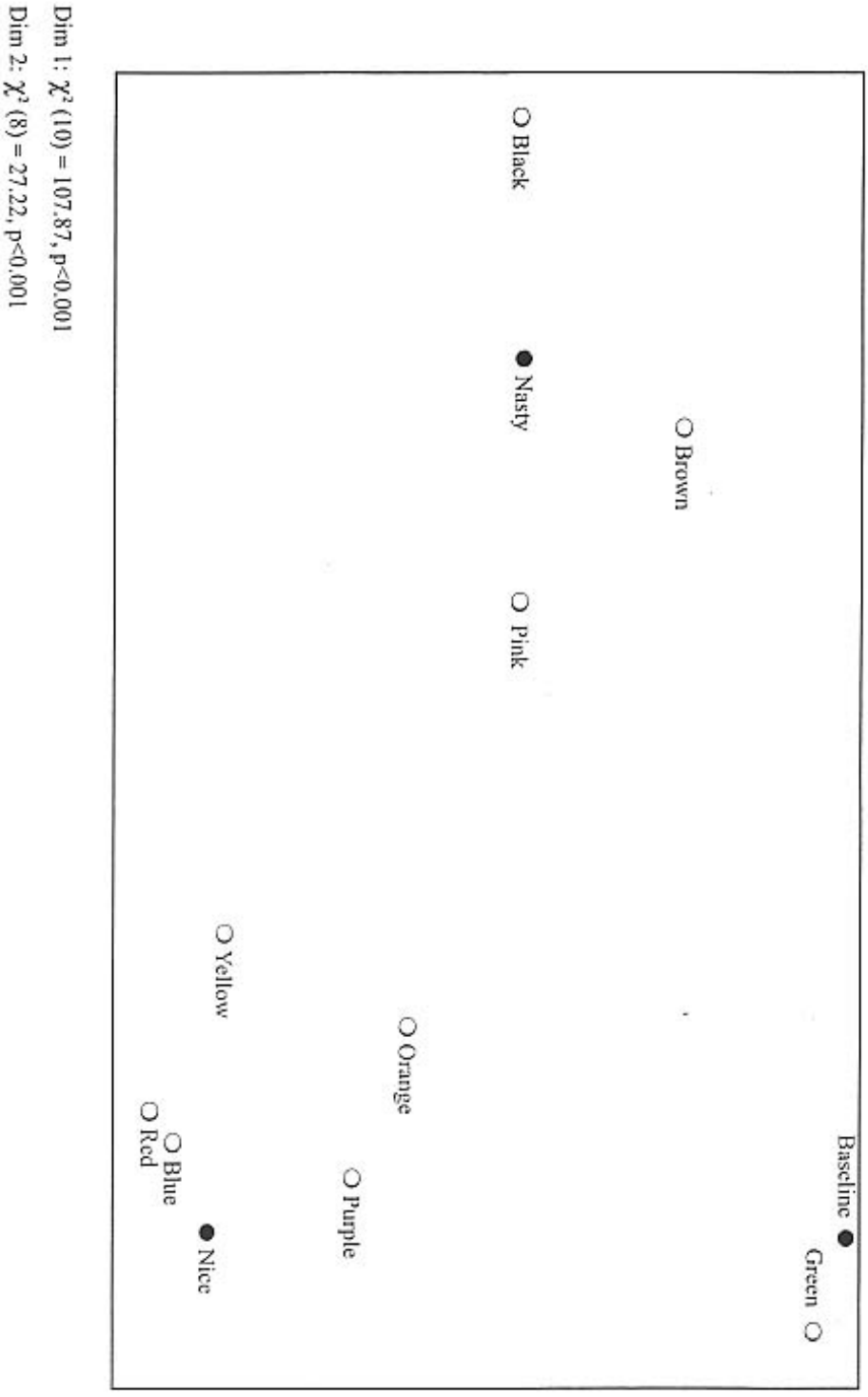

Figure 4: Tree: Colour choices for each drawing task for all age groups together