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Subjective emotion and colour use in drawings

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Abstract

I explored the relationship between subjective emotional experiences and colour use in drawings. Participants in one group were asked to provide a personal emotional response based on each of six drawings depicting emotional scenarios and were asked to colour each drawing. The second group was asked only to colour the drawings. It was hypothesized that those who provided a personal emotional response would colour more features and would use a larger variety of colours than the participants who did not provide a personal emotional response. Describing a personal emotional response led to overall differences in colour use in drawings. Participants did not demonstrate colour-emotion associations found in previous research.

Subjective Emotion and Colour Use in Drawings

Visual structures, including colour, can be expressive. Arnheim (1949) suggested that sensory information contains expression that is "perceptually self-evident". He explained that anything from the human body to inanimate objects such as landscapes and machines has the ability to "project" these expressions onto the surrounding environment. The visual structures in a work of art thus contain expression as well. Arnheim suggested that colour is related to expression and that emotional attitudes are elicited in response to colour. Arnheim further suggested that the perception of colour in artwork leads to emotional experiences in the viewer.

Theories of Emotion

Six recognizable, basic emotions (anger, happiness, sadness, surprise, disgust and fear) have been proposed by Ekman (1973). Ekman, Levenson, and Friesen (1983) suggested that there is a physiological basis for the experience of these six emotions and showed that reliving emotional experiences can cause a physiological response. Physiological responses to emotion were also found in a study involving elderly individuals (Levenson, Carstensen, Friesen, & Ekman, 1991) which suggests that emotional responses remain similar throughout an individual's lifetime.

Freedberg and Gallese (2007) have proposed that universal mirroring mechanisms like those seen in mirror neurons (Fadiga, Fogassi, Pavesi, & Rizzolatti, 1995) are responsible for the empathetic response to art. Fadiga, et al. (1995) originally described the mirror neuron system as a system that matches action observation and execution. They found that when a subject observes an action performed by someone else the muscle activation pattern is similar to the muscle patterns during the execution of the same action (Fadiga et al., 1995). The observation of

static images, including works of art, can lead to action activation in the mirror neuron system of the human brain. When a spectator views an expressive work of art, Freedberg and Gallese (2007) propose that the same emotional circuits are activated in the observer as are demonstrated in the observed work of art.

The mirror neuron system has also been found to be important for social competence (Kaplan & Iacoboni, 2006). Parkinson (1996) has proposed that emotions are social phenomena, and that many emotions are caused interpersonally. The reasons people experience emotions are related to other individuals and often the emotional importance of a situation becomes apparent through interpersonal reasoning. The emotions of other individuals in a situation can also be considered an influencing factor in emotional reactions. Parkinson proposes that emotional situations involve an "Actor" who is the individual experiencing an emotion and a Cause who is the individual eliciting the emotional response in the Actor (Parkinson, 1996).

Theories of Colour and Emotion

The connection between emotion and colour preference can be explained by the ecological colour valence theory of colour preference proposed by Palmer and Schloss (2010). According to their theory colour preferences are a result of people's average emotional responses to objects that are associated with specific colours. Preferences reflect the emotional responses to the colour based on the valence of an object. For example the colour red might be associated with the pleasant taste of a red apple and thus preferred. This might suggest that objects with certain colours which project an affect are also the basis for colour and emotion associations. Palmer and Schloss (2010) suggest that the emotional outcomes in response to "colour-relevant" experiences will result in a heuristic for colour associations, and thus colour preferences, as

individuals learn to associate positive colour-relevant experiences with positive emotions and negative colour-relevant experiences with negative emotions. A study conducted by Kaya and Epps (2004) explored emotional responses to colours and their findings support the Ecological Valence Theory. Participants associated emotions with certain colours based on their previous reported experience with a given colour; for example, blue was associated with negative emotions because it reminded participants of the night time and dark skies.

Gao and Xin (2006) found evidence for colour and emotion associations in their study using college students. They found that the chroma or intensity of colour has an effect on that colour's perceived emotion on a scale of cold-warm ratings. A small variation in the intensity of a colour resulted in the perceived emotion of that colour region. High chroma of a colour resulted in the colour being perceived as warm.

Jue and Kwon (2013) conducted a study where participants judged drawings of psychologically healthy people and individuals presenting with emotional distress. Judging emotional states was more accurate in drawings with colour as opposed to achromatic drawings. Individuals with a psychological condition used less colour than their healthy counterparts in drawings, and participants were able to accurately choose the drawings they felt were coloured by psychologically unhealthy individuals based on this difference. The researchers concluded that colour is a major source of information in assessing emotional states. Burkitt (2004) found that children's drawings can also contain information about emotional states. She suggested that children's drawings are viewed as cheerful and positive when they contain bright colours. Adults also conclude that a child was distressed while drawing if the drawing contains dark colours (Burkitt, 2004). Considering these results that demonstrate emotional states are portrayed in

artwork, it can be concluded that drawings are representations of inner experiences of feelings and emotions and that colour must have universal aspects that communicate emotional content; otherwise artwork could only be appreciated by the creator (Jue & Kwon, 2013).

Zentner (2001) suggested that children are able to attribute emotions to paintings at an early age. He found that colours carry emotional meanings for children and he concluded that children have the capacity to perceive relationships between colour and emotion. He found that by three years of age children are associating happiness with bright colours such as yellow and sadness with dark colours such as blue.

Colour and Emotion in Drawings

Humphrey (2002) had participants make abstract line drawings with a chosen colour based on each of Ekman's (1973) six basic emotions. Colour-emotion associations were consistent with Zentner's (2001) findings as is evident in the following colour-emotion associations: red with anger, orange with surprise, yellow with happiness, green with disgust, blue with sadness and black with fear (Humphrey, 2002). Tull (2008) had adults paint abstract representations of Ekman's (1973) basic emotions and found the same colour-emotion associations as Humphrey (2002). Baxter (2007) had children, adolescents, adults, and older adults make drawings that depicted scenarios that corresponded to Ekman's (1973) basic emotions and she also found colour-emotion associations that were consistent with the previous research (Zentner, 2001; Humphrey, 2002). This research suggests that colour-emotion associations are not only present when viewing drawings but that individuals also demonstrate colour-emotion associations when producing drawings, which is consistent with Jue and Kwon's (2013) statement that colours must contain universal aspects that communicate emotion.

Hermsen (2012) explored colour-emotion associations in colouring drawings of characters in both the actor and cause role. Each drawing depicted a different emotional scenario including Ekman's (1973) six basic emotions. The colour-emotion associations were consistent with previous research (Humphrey, 2002). Some emotions produced several colour associations; she concluded that this could be due to the fact that the drawings could be perceived as depicting several emotions (Hermsen, 2012).

Current Study

The current study was conducted to explore whether subjective emotional experiences would affect colour use in drawings. Participants coloured six drawings depicting scenarios based on Ekman's (1973) six basic emotions. One group of participants was asked to describe a personal emotional response based on each of the drawings before they completed the colouring task while a second group of participants just completed the colouring task. It was hypothesized that participants in both groups would demonstrate the colour-emotion associations found in previous research since it has been established in past research that colour must have some universal aspect that enables colour-emotion associations (Jue & Kwon, 2013) and that there are specific colour-emotion associations (Zentner 2001; Humphrey, 2002; Baxter, 2007; Tull, 2008; Hermsen; 2012). The dependent variable that was analyzed was colour use, and the independent variable was emotion. It was also hypothesized that participants describing a personal emotion would colour more features in the drawings and use a larger variety of colours. The hypothesis that having participants describe a personal response would lead to differing colour use was based on the idea that participants in this group would have a better and more subjective understanding of the emotions demonstrated in the drawings based on empathy theories

(Freedberg & Gallese, 2007) and the Ecological Valence Theory (Palmer & Schloss, 2010) which draws on past experience. Thus asking participants to describe a personal emotional experience would lead to an emotional response elicited by greater empathy and evocation of past experience, and this past experience would affect colour use.

Method

Participants

The participants of this study were psychology students at King's University College. They were recruited through the SONA system which is an online system that allowed students to sign up to participate in the study at a time of their choice. Participants were also approached in upper year psychology classes on the King's campus. Participation was voluntary and the participants made up a convenience sample (N=28, 18 females) with an age range of 18-34 years (M = 20.89, SD = 3.67).

Materials

A colouring booklet of 6 drawings (see Appendix A) and several boxes of 24 coloured crayons were used. Each colouring book included an instruction page and consisted of 6 different drawings depicting a scenario of two gender-neutral characters representing Ekman's (1973) emotions: anger, surprise, happiness, disgust, sadness and fear. The drawings featured a limited number of aspects to colour (clothing, and a few relevant objects). The colouring booklets also had question sheets that correspond to each drawing. The question sheets for the experimental condition had questions regarding "Actor" and "Cause" (Parkinson, 1996), first impressions about the drawings, and a question about personal experience and emotion (Appendix B), and the question sheets for the control condition only asked the participants to label Actor and Cause

(Appendix C). The order of the drawings in each colouring book was randomized. A demographic questionnaire (Appendix D) with questions regarding age and gender as well as questions about colour blindness (e.g. “Have you been tested for colour blindness?” and “Have you been diagnosed with colour blindness?”) was also used.

Procedure

Participants were randomly assigned to one of two groups and given the demographic questionnaire (Appendix D), a colouring booklet, and a set of 24 crayons. The participants completed the questionnaire and colouring booklet individually.

Personal Emotion Group. Participants in the Personal Emotion group were asked to label the Actor and the Cause in a drawing. Participants were then asked to write their first impressions of what was happening in each scenario. They were then asked to describe what they would personally feel if they were in a situation similar to that of the Actor in each drawing, and they were informed that they did not have to answer if they did not want to. Participants in this group were asked to colour each drawing after answering the questions. This process was repeated for each drawing.

Colouring Only Group. In the Colouring Only group, participants were asked to label the Actor and the Cause in each drawing. They were then asked to colour the drawing. This process was repeated for each drawing.

Participants were given an hour to finish all 6 drawings. After participants completed the colouring book, they were debriefed on the nature of the study. Those who participated for the Introductory Psychology extra credit assignment were given a questionnaire that was completed for receiving the extra credit.

Results

The colours of crayons (Table 1) were categorized as one of the following: red, orange, yellow, green, blue, purple, brown, black or white. The drawings were then analyzed for type of features that were coloured based on those colour categories. A list of the features that were coloured can be found in Table 2.

The data were analyzed using a repeated measures General Linear Model design in SPSS20. A MANOVA was created with scene, character, and colour as the within-subjects variables and condition (Personal Emotion or Colouring Only) as the between-subjects variable. A main effect of scene was found, Hotelling's $T^2 = 1.2$, $F(5, 22) = 5.4$, $p = .01$. There was also a main effect of colour, Hotelling's $T^2 = 14.7$, $F(9, 18) = 29.5$, $p = .01$. There was an interaction between scene and character, Hotelling's $T^2 = 1.9$, $F(5, 22) = 8.5$, $p = .01$. There was also an interaction between character and colour, Hotelling's $T^2 = 4.3$, $F(9, 18)$, $p = .05$. A within-subjects trend analysis of the data showed a linear trend across the scene variable, $F(1) = 14.6$, $p = .001$.

The colour-emotion associations for the Actor and Cause for each emotional scenario are shown in Figures 1-12. The expected colour-emotion associations were found for the Actor in the disgust scenario (Figure 7) with brown being used to colour features most frequently, and for the Actor in the fear scenario (Figure 11) with black being used to colour features most frequently. An ANOVA was conducted on each emotional scenario by condition to determine if there were significant differences in colour use between the conditions. The only significant interaction between scenario and condition was for the Actor in the anger scenario, Hotelling's $T^2 = 2.0$, $F(9, 18) = 3.9$, $p = .01$.

Table 1

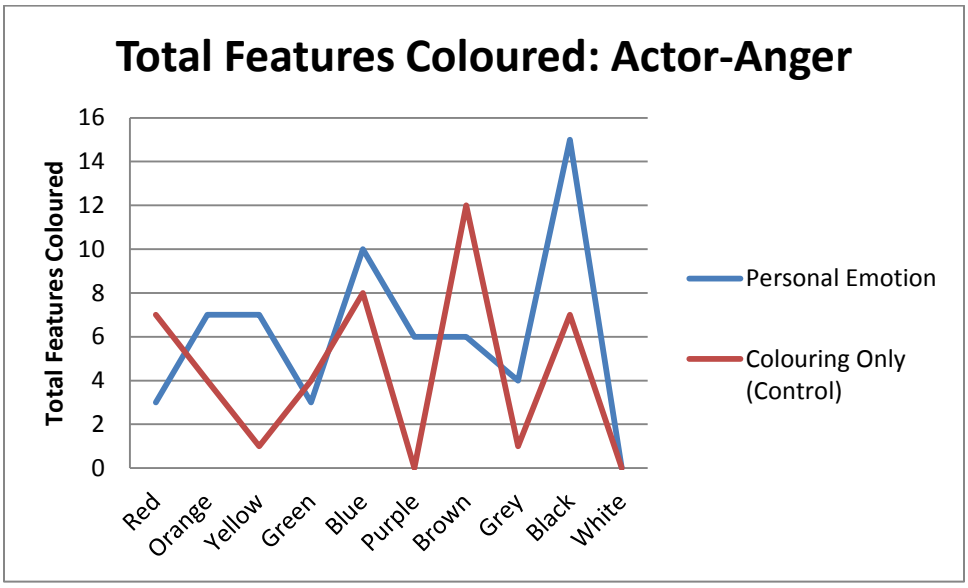
Crayola crayon colours.

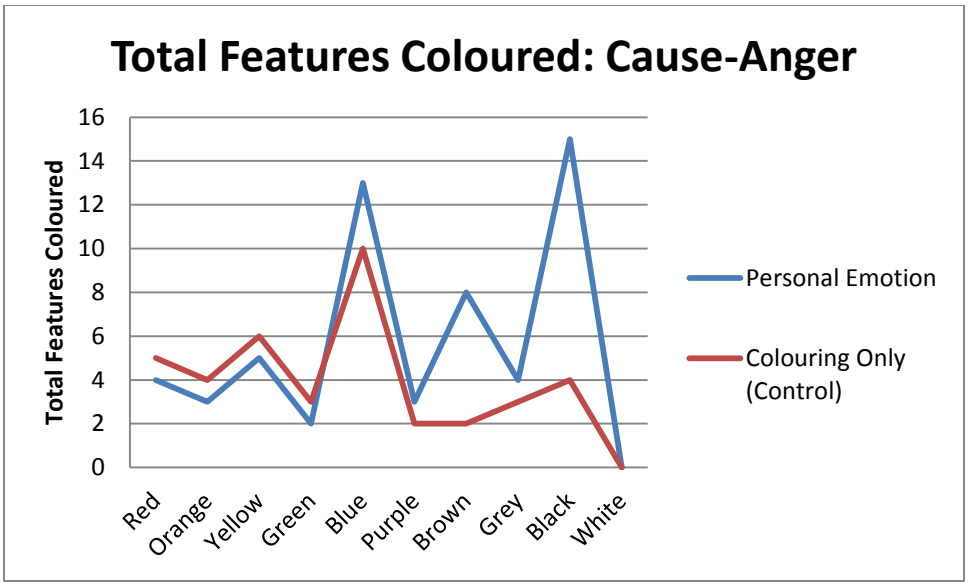
	Crayon name	Colour	Category
1	**White**		White
2	**Grey**		Grey
3	**Black**		Black
4	**Brown**		Brown
5	**Violet**		Purple
6	**Blue-Violet**		Purple
7	**Indigo**		Blue
8	**Blue**		Blue
9	**Cerulean**		Blue
10	**Blue-Green**		Blue
11	**Green**		Green
12	**Yellow-Green**		Green
13	**Green-Yellow**		Yellow
14	**Yellow**		Yellow
15	**Dandelion**		Yellow
16	**Yellow-Orange**		Orange
17	**Apricot**		Orange
18	**Orange**		Orange
19	**Orange-Red**		Red
20	**Pink**		Red
21	**Scarlet**		Red
22	**Red**		Red
23	**Violet-Red**		Purple
24	**Red-Violet**		Purple

Table 2

Summary of features coloured in drawings for Actor and Cause in each emotional scenario.

Anger					
Clothes		**Objects**		**Other**	
Actor	Cause	Actor	“Cause	Actor	Cause
Shirt	Shirt			Skin	Skin
Pants	Pants			Hair	Hair
Shoes	Shoes				
Surprise					
Clothes		**Objects**		**Other**	
Actor	Cause	Actor	Cause	Actor	Cause
Shirt	Shirt		Cake	Skin	Skin
Pants	Pants		Candles	Hair	Hair
Shoes	Shoes				
Happiness					
Clothes		**Objects**		**Other**	
Actor	Cause	Actor	Cause	Actor	Cause
Shirt	Shirt	Ball	Ball	Skin	Skin
Pants	Pants			Hair	Hair
Shoes	Shoes				
Disgust					
Clothes		**Objects**		**Other**	
Actor	Cause	Actor	Cause	Actor	Cause
Shirt	Shirt	Mud	Mud	Skin	Skin
Pants	Pants	Water stain	Water stain	Hair	Hair
Shoes	Shoes				
Sadness					
Clothes		**Objects**		**Other**	
Actor	Cause	Actor	Cause	Actor	Cause
Shirt	Shirt	Rock	Suitcase	Skin	Skin
Shoes	Shoes		Case handle	Hair	Hair
Pants	Pants		Case pockets		
Fear					
Clothes		**Objects**		**Other**	
Actor	Cause	Actor	Cause	Actor	Cause
Shirt	Shirt		Skunk	Skin	Hair
Pants	Pants				
Shoes	Shoes				


Total Features Coloured: Actor-Anger
Total Features Coloured
16
14
12
10
8
6
4
2
0
Red
Orange
Yellow
Green
Blue
Purple
Brown
Grey
Black
White
Personal Emotion
Colouring Only (Control)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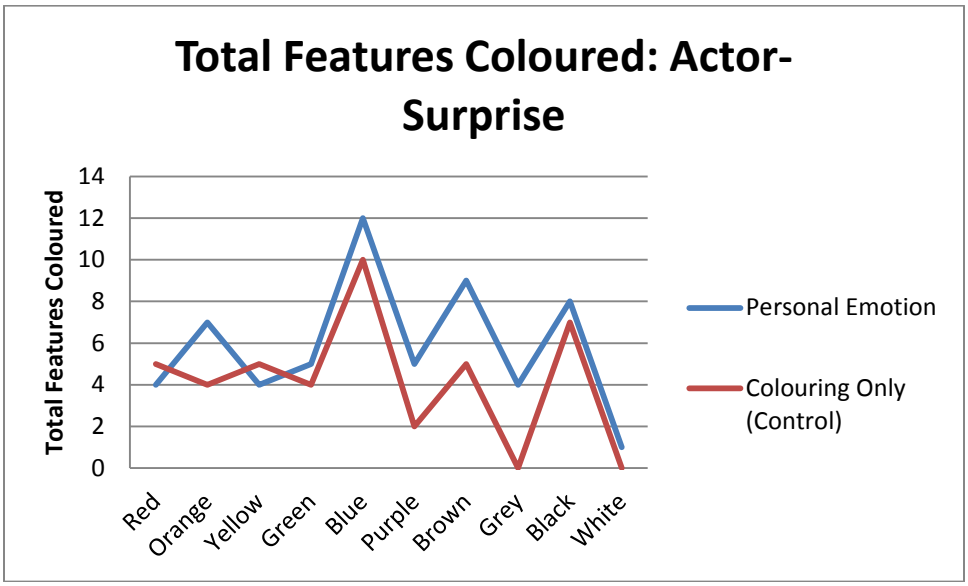
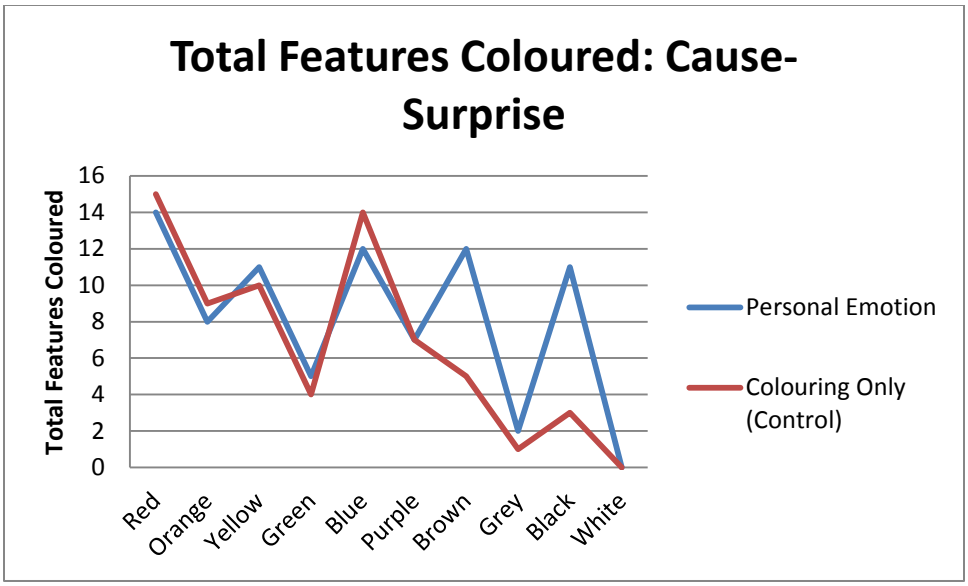
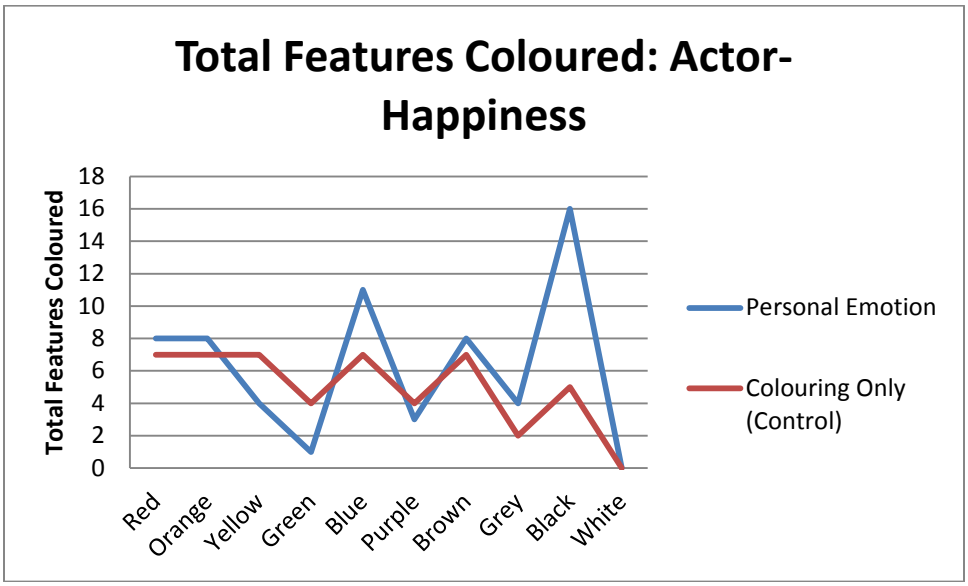
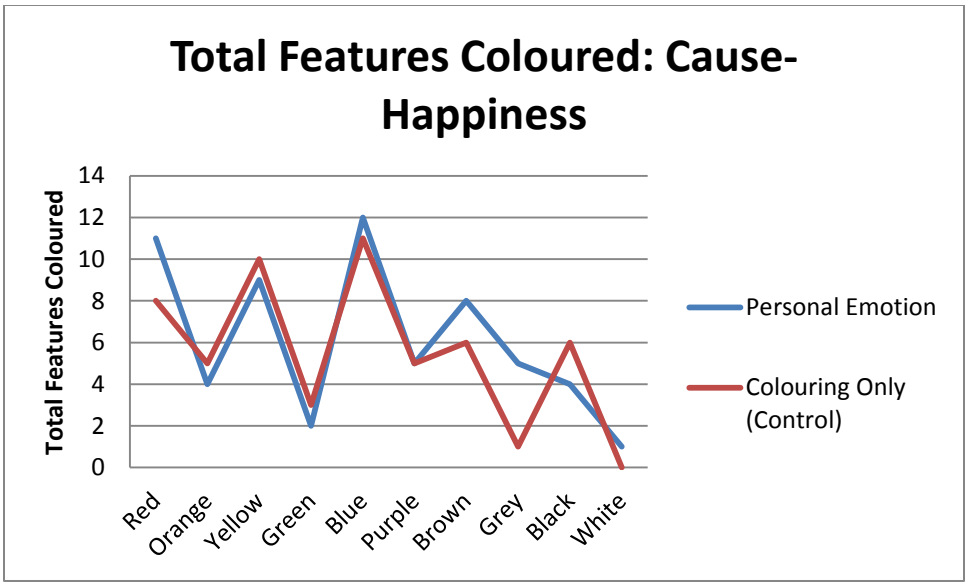
Total Features Coloured
16
14
12
10
8
6
4
2
0
Red
Orange
Yellow
Green
Blue
Purple
Brown
Grey
Black
White
Personal Emotion
Colouring Only (Control)


Total Features Coloured: Actor-Surprise
Total Features Coloured
14
12
10
8
6
4
2
0
Red
Orange
Yellow
Green
Blue
Purple
Brown
Grey
Black
White
Personal Emotion
Colouring Only (Control)


Total Features Coloured: Cause-Surprise
Total Features Coloured
16
14
12
10
8
6
4
2
0
Red
Orange
Yellow
Green
Blue
Purple
Brown
Grey
Black
White
Personal Emotion
Colouring Only (Control)


Total Features Coloured: Actor-Happiness
Total Features Coloured
18
16
14
12
10
8
6
4
2
0
Red
Orange
Yellow
Green
Blue
Purple
Brown
Grey
Black
White
Personal Emotion
Colouring Only (Control)


Total Features Coloured: Cause-Happiness
Total Features Coloured
14
12
10
8
6
4
2
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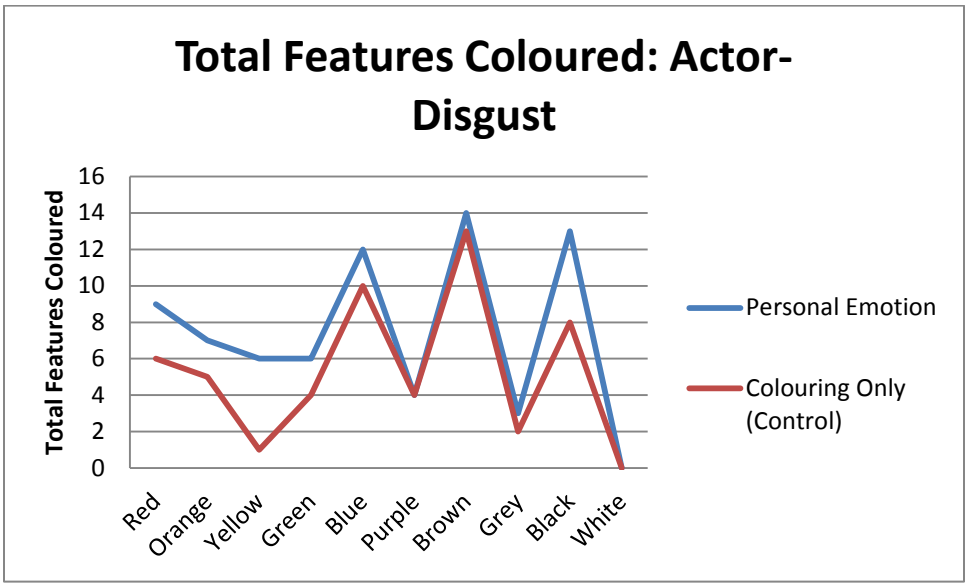
Yellow
Green
Blue
Purple
Brown
Grey
Black
White
Personal Emotion
Colouring Only (Control)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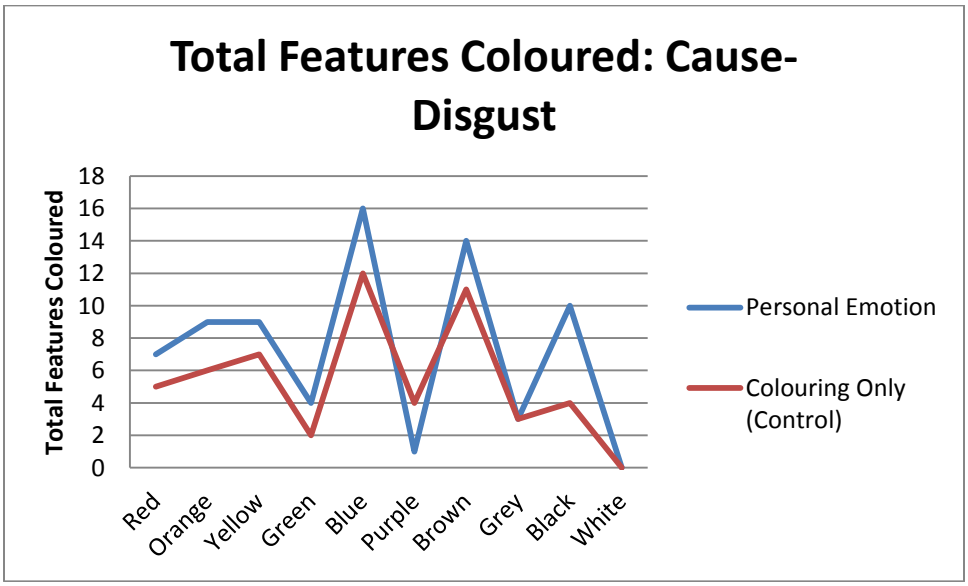
Total Features Coloured
16
14
12
10
8
6
4
2
0
Red
Orange
Yellow
Green
Blue
Purple
Brown
Grey
Black
White
Personal Emotion
Colouring Only (Control)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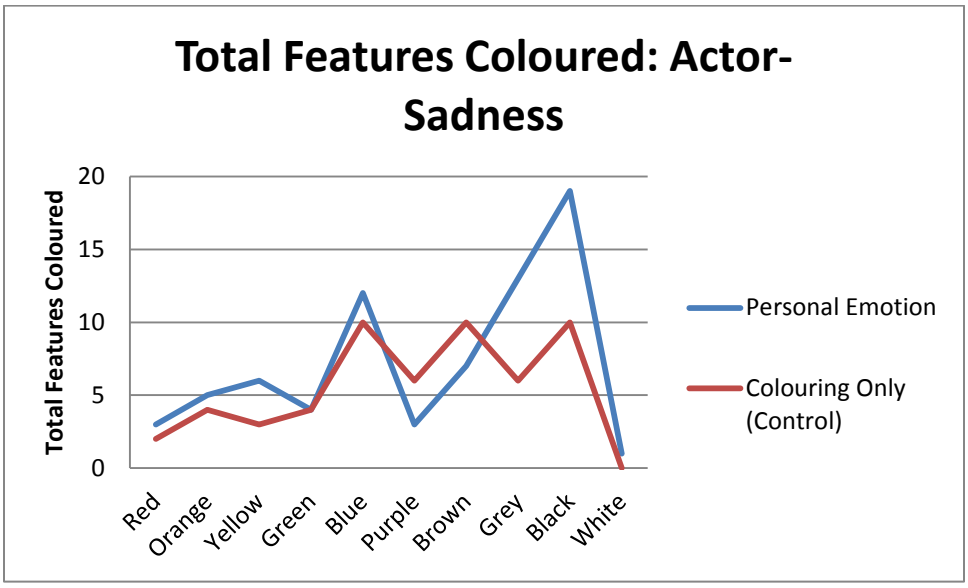
Total Features Coloured
18
16
14
12
10
8
6
4
2
0
Red
Orange
Yellow
Green
Blue
Purple
Brown
Grey
Black
White
Personal Emotion
Colouring Only (Control)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Total Features Coloured
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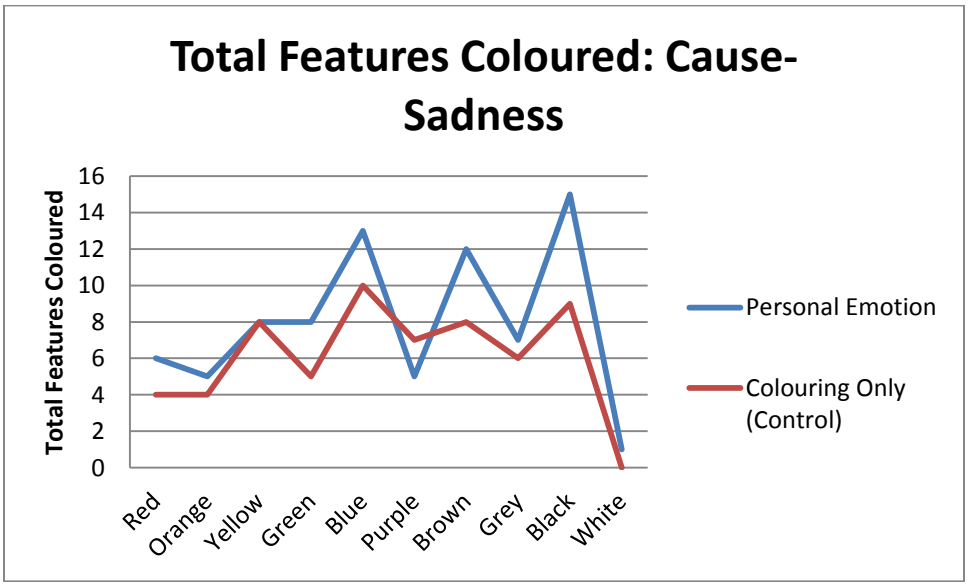
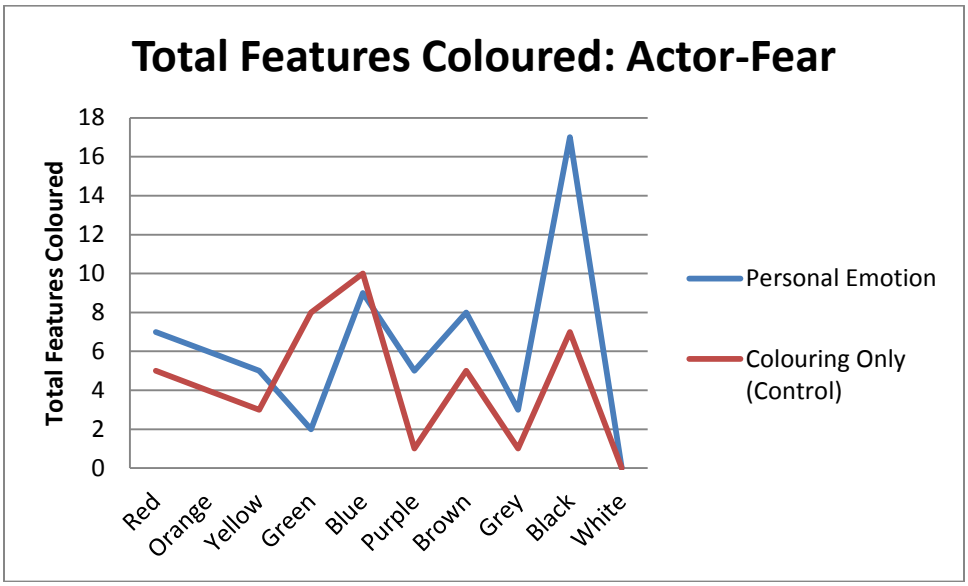
15
10
5
0
Red
Orange
Yellow
Green
Blue
Purple
Brown
Grey
Black
White
Personal Emotion
Colouring Only (Control)


Total Features Coloured: Cause-Sadness
Total Features Coloured
16
14
12
10
8
6
4
2
0
Red
Orange
Yellow
Green
Blue
Purple
Brown
Grey
Black
White
Personal Emotion
Colouring Only (Control)



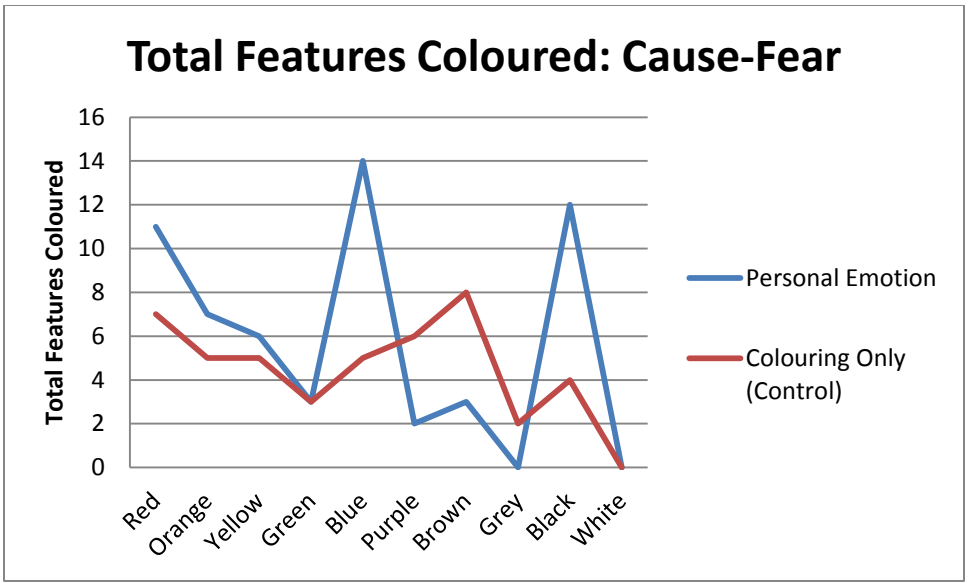


Figure 1. Number of features of the Actor and Cause coloured in each scenario for both groups.

Discussion

The main effect found for the scene variable (within-subjects) suggests that there are overall differences in the way each emotional scenario was coloured. This supports the notion that there are differences between the emotional scenarios that make them distinct and recognizable as reflected in the choice to colour them differently. The main effect found for colour (within-subjects) suggests that there are overall differences in colours used between drawings. The interaction that was found between scene and character (within-subjects) suggests that there are differences in the way the Actor and Cause are coloured across the scenarios, which is also in line with Ekman's (1973) proposal that emotions are distinct. Finally, the interaction found between character and colour (within-subjects) suggests that there are overall differences in how the Actor and Cause were coloured. This supports Parkinson's (1996) proposal that the Actor and Cause are distinct characters. The differing colour use found in the current study suggests that while the Cause is eliciting an emotional response from the Actor, the Cause may also be perceived to be experiencing different emotions as well.

The hypothesis that each group would demonstrate the colour-emotion associations that have been found in previous research (Zentner 2001; Humphrey, 2002; Baxter, 2007; Tull, 2008; Hermsen; 2012) was not supported. The peaks of each graph (Figures 1-12) demonstrate the colour that was used most often for colouring different features of the respective character, the Actor or the Cause, for each emotional scenario. The only instance where the colour-emotion associations were consistent with past research was for the "Actors" in the disgust (Figure 7) and fear (Figure 11) scenarios with brown and black being used to colour features the most, respectively. This could be due to the fact that when the participants were asked to describe a

personal emotional response there could have been other emotions activated (Table 4), and the colours that were used could have been associated with those other emotions. For example, a common emotion that was cited as a personal emotional response in the surprise scenario was happiness. The lack of colour-emotion associations that are consistent with past research could also be due to the overabundance of blue and black that was used to colour the drawings for features such as pants and shoes respectively. However, blue jeans and black shoes are common clothing items, so the fact that blue and black were used to colour pants and shoes may suggest that participants were drawing from past experience to some extent.

Despite the implication that past experience may have been an important factor in colour-emotion associations and colour use, the results did not support the hypothesis that it would create significant differences in colour use. This could be due to the fact that the emotional responses were not personally relevant. Many of the responses just reiterated the emotion and reasoning that was provided with each scenario (Table 4). The only significant difference in colour use between the conditions was for the Actor in the anger scenario. According to Fredrickson (1998) anger is one of the most salient emotions so the minimal emotional response

Table 4

Summary of personal emotional responses to the instructions "Describe how you would personally feel if you were in a situation that is similar to that of the 'actor' in the drawing".

Anger
Annoyed, mad, irritated, hurt, rejected, upset, angry
Surprise
Happy, excited, shocked, loved, surprised, giddy
Happiness
Happy, nervous, giddy, joy
Disgust
Disgusted, annoyed, angry, grossed out, upset, furious
Sadness
Sad, upset, despair, depressed, happy, lonely
Fear
Fear, sad, afraid, nervous, mad, angry, worry

for anger when identifying with the angry Actor might have been enough to create differences in colour use. If participants were required to give a specific example of the last time they experienced each of the emotions this might have had more of an effect as it would have been more subjective rather than just a reiteration of the given scenario and emotion. Perhaps having participants create drawings instead of colouring drawings, there might have been more of an effect as well.

So, the current study did not support the hypothesis that participants would demonstrate colour-emotion associations that are consistent with past research. Additionally, the results did not support the hypothesis participants who described a personal emotional response would significantly differ in their colour use from those who did not have a personal emotional response. Since the personal responses given by participants suggest that there may be several emotions at play in social interactions, future research could explore whether colour use in drawings can capture the complex emotional responses in social interactions. Perhaps this could be studied by having participants create a narrative of a social interaction and having them create drawings using colour and then the drawings could be analyzed for colour-emotion associations.

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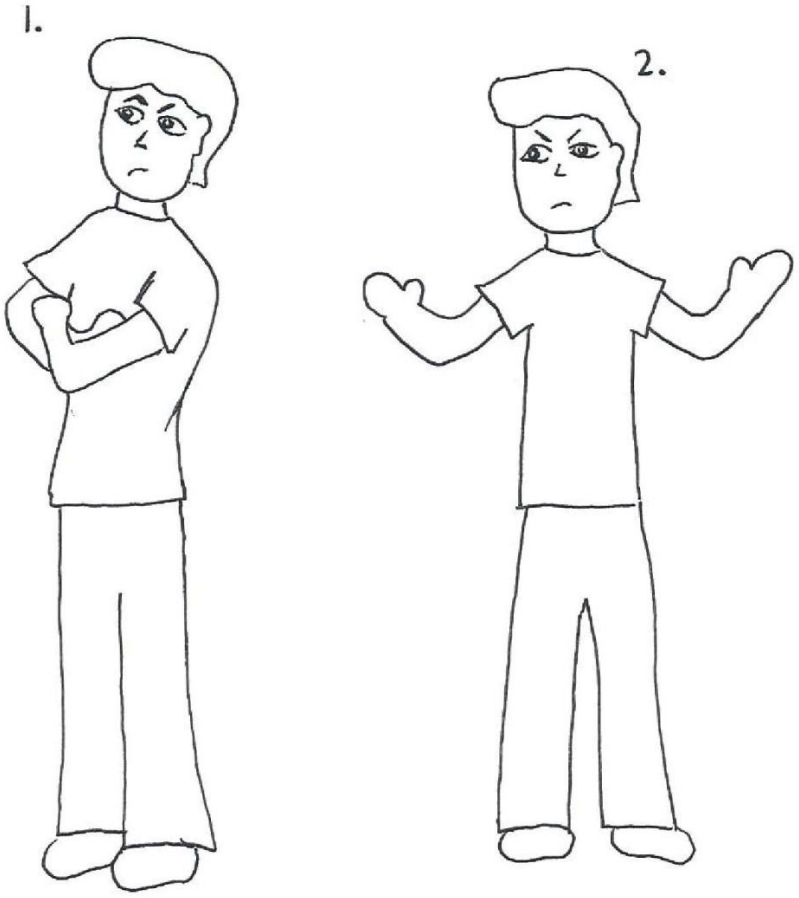
Zentner, M. R. (2001). Preferences for colours and colour–emotion combinations in early childhood. *Developmental Science, 4*(4), 389-398.

Appendix A

Anger: You are angry because your friend is ignoring you.

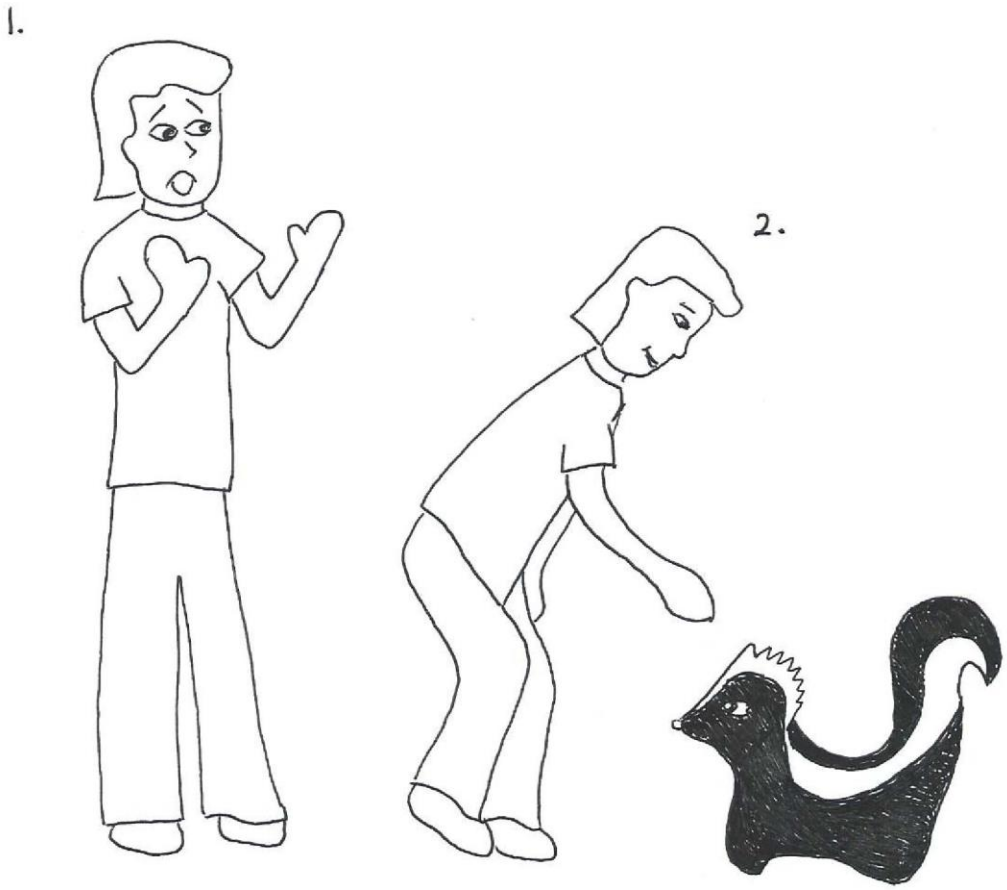


____ Actor
____ Cause

Disgust: You are disgusted when your friend jumps in a puddle and splashes you.

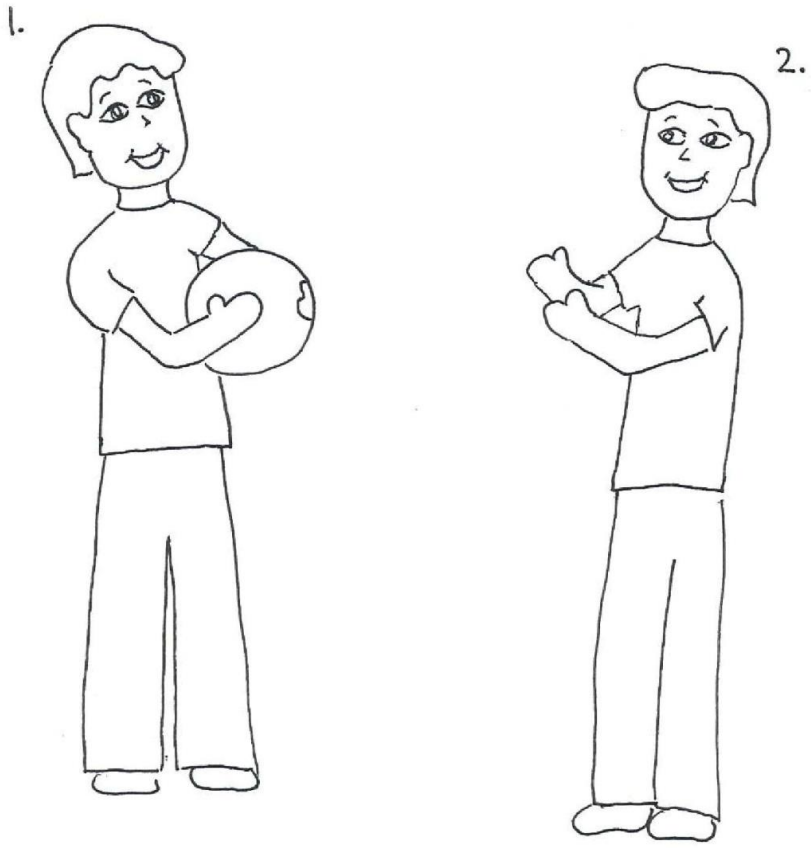
____ Actor
____ Cause

Fear: You are afraid when your friend tries to touch a skunk.



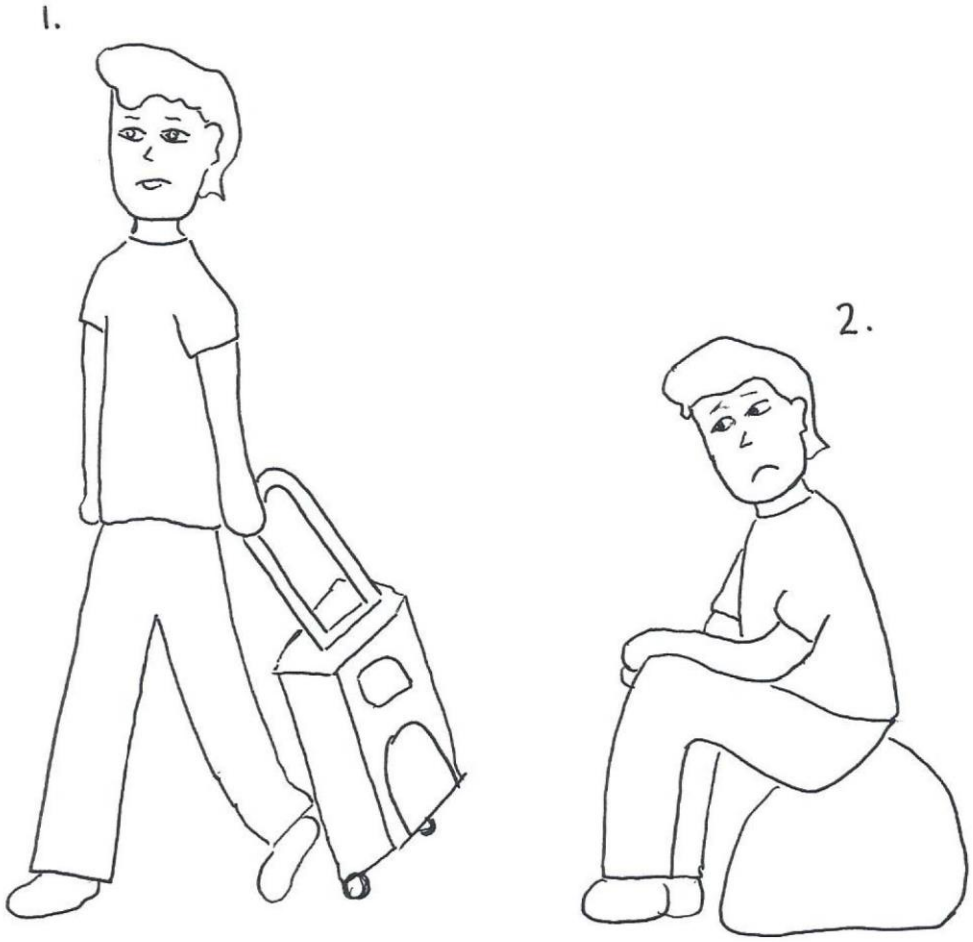
____ Actor
____ Cause

Happiness: You are happy to be with your friend.



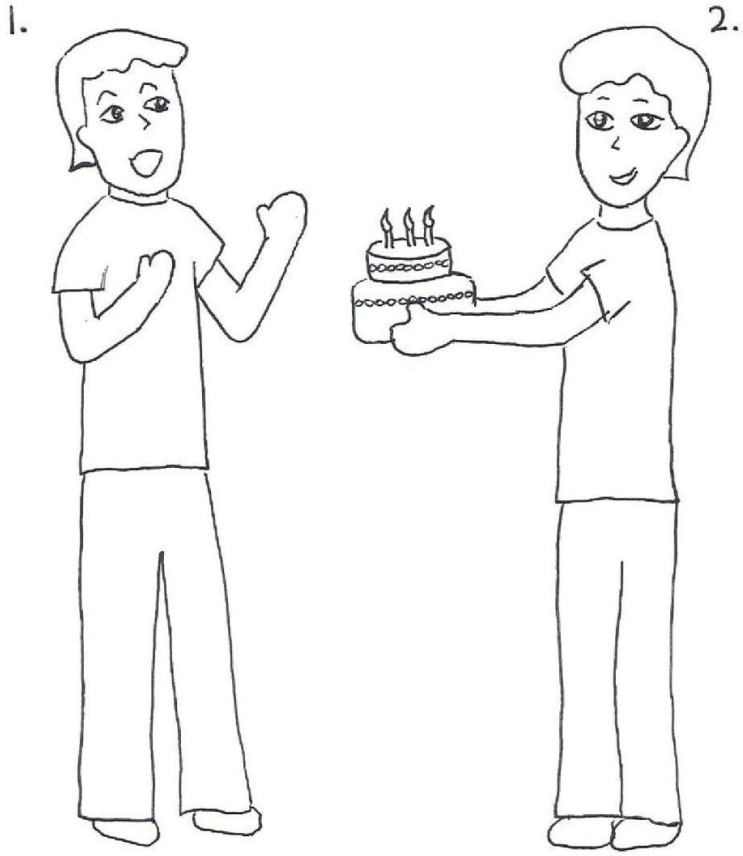
____ Actor
____ Cause

Sadness: You are sad because your friend is leaving.



____ Actor
____ Cause

Surprise: You are surprised when your friend brings you a cake.



____ Actor
____ Cause

Appendix B

Personal Emotion Group

1. Please read the sentence at the top of the opposite side of this page and look at the picture. Identify the "actor" and the "cause" in the drawing. The "actor" is the character that is experiencing the given emotion, and the "cause" is the character that is creating the emotional response. Please write the numbers that you believe correspond to the "actor" and the "cause" in the spaces provided on the opposite side of the page.

2. In the space provided below, please give your first impression of what is happening in the drawing on the opposite side of the page and what you believe is being felt by each of the characters in 1-2 sentences.

3. In the space provided below, please describe how you would personally feel if you were in a situation that is similar to that of the Actor in the drawing. You do not have to answer if you feel uncomfortable doing so.

4. Please use the provided materials to colour the drawing on the opposite side of the page.

Appendix C

Colouring Only Group

1. Please read the sentence at the top of the opposite side of this page and look at the picture. Identify the “actor” and the “cause” in the drawing. The “actor” is the character that is experiencing the given emotion, and the “cause” is the character that is creating the emotional response. Please write the numbers that you believe correspond to the “actor” and the “cause”.

2. Please use the provided materials to colour the drawing.

Appendix D

Please complete the following questionnaire.

Please check the appropriate box.

- ☐ Male
- ☐ Female

Age: _____

Please answer the following questions to the best of your ability.

Have you been tested for colour blindness? (Check the appropriate box.)

- ☐ Yes
- ☐ No

Have you been diagnosed with colour blindness? (Check the appropriate box.)

- ☐ Yes
- ☐ No
- ☐ Not applicable

If you have been diagnosed with colour blindness, please specify the type of colour blindness in the space below.