

**AN EXPLORATION OF HOW TYPICAL PUPILS AND PUPILS  
WITH AUTISM OR ASPERGER'S SYNDROME DRAW  
FACES**

By

CERI BRENDAN EDWARDS

A thesis submitted to the University of Birmingham for the degree of  
Master of Philosophy B (Ed)

School of Education  
University of Birmingham  
Edgbaston, Birmingham  
B15 2TT, United Kingdom

UNIVERSITY OF  
BIRMINGHAM

**University of Birmingham Research Archive**

**e-theses repository**

This unpublished thesis/dissertation is copyright of the author and/or third parties. The intellectual property rights of the author or third parties in respect of this work are as defined by The Copyright Designs and Patents Act 1988 or as modified by any successor legislation.

Any use made of information contained in this thesis/dissertation must be in accordance with that legislation and must be properly acknowledged. Further distribution or reproduction in any format is prohibited without the permission of the copyright holder.

## Abstract

This study aimed to explore whether there are differences identified in visual processing, and whether this can be observed in how adolescents with autism draw a face when compared to a typically developing control group. A review of the literature highlighted that many studies used object drawing tasks of geometric shapes when researching in this area.

This study is a qualitative case study, informed by mixed methods and a pragmatic perspective using a purposive sample for selection of the participants.

The findings of this study identified five key findings, as follows:

A lack of draw towards the eyes; Random eye tracking; Problem of local facial processing; a lack of support for the current view that there is a bias towards local fine detail processing in autism and a deficit in global processing; a difference in top-down bottom-up processing of eyes between the two groups, which may be worth exploring in further studies.

Further research in this area would enable educators and other health and social care professionals to address this weakness at an early age to potentially reduce the impact on the child's development and social awareness.

## Dedication

With thanks to the two secondary school pupils, parents, and teachers

## Acknowledgments

With thanks to Dr Glenys Jones, Prof. Michael McLindon and Birmingham University

<b>Table of Contents</b>	<b>Page</b>
<b>Abstract</b> .....	<b>2</b>
<b>Chapter 1</b> .....	<b>8</b>
1.1 Introduction .....	8
1.2 Rationale for the study .....	8
1.3 Autism and visual processing .....	9
1.4 The perception of a drawn image.....	10
1.5 Aim of the study .....	11
1.6 Purpose and potential significance of the study .....	11
<b>Chapter 2 Review of the literature</b> .....	<b>12</b>
2.1 Introduction .....	12
2.2 Searching the literature .....	12
2.3 Focus of the studies in Table 3.....	17
2.4 Research design used in the studies in Table 3 .....	18
2.5 Summary of the areas researched from the literature reviewed.....	18
<i>2.5.1 Visual processing when drawing in typically developing individuals</i> ...	18
<i>2.5.2 Top-down bottom-up processing</i> .....	20
<i>2.5.3 Visual processing and face recognition</i> .....	21
<i>2.5.4 Autism and visual processing of faces</i> .....	22
<i>2.5.5 Eye gaze</i> .....	24
2.6 Global and local processing.....	28
2.7 Enhanced perceptual functioning and weak central coherence.....	32
2.8 Drawing and visual processing.....	33

2.9 Autism and drawing a face.....	35
2.10 Summary of the chapter .....	36
2.11 Research questions.....	37
<b>Chapter 3 Methodology and sample .....</b>	<b>38</b>
3.1 Introduction.....	38
3.2 Research design .....	38
3.3 Piloting the study.....	41
3.4 Selecting the participants for the main study.....	42
3.5 Ethical issues .....	43
3.6 Reducing bias.....	44
3.7 Research methods .....	45
3.7.1 Materials .....	46
3.7.2 Images .....	46
3.7.2.1 Drawing a face from memory.....	47
3.7.2.2 Draw the face of a life model (the teacher).....	47
3.7.2.3 Draw a cartoon face.....	47
3.7.2.4 Draw a face from a photograph.....	48
3.7.2.5 Draw a self-portrait of their own face.....	48
3.7.2.6 Rationale for the participants to produce line drawings over other art styles.....	48
3.8 Procedure.....	49
3.8.1 Research setting.....	49
Step 1: Setting up the room before the participant arrived	
3.8.2 Step 2: Welcoming the students into the research setting.....	53

3.8.3 Step 3: Undertaking and recording the tasks.....	54
3.8.4 Step 4: Follow-up questions.....	54
3.8.5 Step 5: Student debrief.....	56
3.8.6 Notes taken by the researcher during the drawing process.....	57
<b>Chapter 4: Findings and discussion .....</b>	<b>59</b>
4.1 Introduction .....	59
4.2 Checking the reliability of the coding.....	59
4.3 Defining the features to be analysed.....	59
4.4 Coding the features to be analysed.....	61
4.4.1 Recording of partially completed features.....	61
4.4.2 Face and eyes.....	63
4.5 Difficulties analysing the data.....	66
4.5.1 Quantified data and descriptive statistic.....	66
4.6 Finding.....	70
4.6.1 Further analysis.....	71
4.6.2 Definitions of the level of detail.....	77
4.6.3 Illustrated definition of detail.....	78
4.6.4 Touch-ups and revisions after the main features had been drawn.....	82
4.6.5 Results highlighting a difference seen in the level of detail given to each feature.....	84
4.6.6 Participants' use of reference points when drawing.....	93
4.6.7 Use of sources.....	94
4.6.8 Amount of interest the participants appeared to show in the task.....	96
4.6.9 Time.....	100

4.6.9.1 <i>Follow-up questions on completion of the tasks</i> .....	101
4.6.10 <i>Question one</i> .....	103
4.6.11 <i>Question two</i> .....	104
<b>Chapter 5 Conclusions and implications</b> .....	<b>107</b>
5.1 Introduction.....	107
5.2 Key findings in relation to research question 1.....	107
5.2.1 <i>A summary of the results</i> .....	107
5.2.2 <i>Order of the features drawn</i> .....	108
5.2.3 <i>Cartoon drawing task</i> .....	108
5.2.4 <i>Level of detail in their drawings</i> .....	109
5.2.5 <i>Corrections and the use of a reference point</i> .....	109
5.2.6 <i>Follow-up questions</i> .....	110
5.2.6.1 <i>Limitations to the follow-up questions</i> .....	112
5.2.7 <i>Top-down and bottom-up processing: what do the findings suggest?</i>	113
5.3 Summary of findings in relation to question 1.....	115
5.4 Key findings in relation to research question 2.....	115
5.4.1 <i>A lack of draw to the eyes</i> .....	115
5.4.2 <i>Random eye tracking</i> .....	116
5.4.3 <i>Problem of local facial processing</i> .....	117
5.4.4 <i>This study does not support the view of a bias towards fine detail in autism</i> .....	119
5.4.5 <i>Differences seen in relation to top-down bottom-up processing</i> .....	121
5.5 ideas for further research.....	122
5.5.1 <i>Limitations of the study</i> .....	123
5.5.2 <i>Next steps</i> .....	126

References .....	127
Appendix.....	135
A1 - Chapter 3 .....	135
A1.1 Ethical approval for the study.....	135
A1.2 Example cover letter for parents.....	137
A1.3 Example Information sheet for participants.....	138
A1.4 Example information sheet for parents.....	140
A1.5 Example information sheet for Head teachers.....	142
A1.6 Example consent form .....	144
A2- Chapter 4.....	145
A2.1 Responses to follow up questions asked.....	145

Word count 19886 (excluding tables and figures)

# CHAPTER 1

## 1.1 Introduction

This study is concerned with researching how individuals with autism register visual information when looking at a face, and how this compares to those without a diagnosis of autism. This chapter presents the rationale and context of the study, and gives an outline of what is known in relation to autism and visual processing. The researcher describes how observed differences in drawn images influenced the initial thinking and development of this research study, and explains the potential benefits of gaining a greater understanding of how individuals with autism process faces. The chapter concludes with the aims and potential significance of the study.

## 1.2 Rationale for the study

This research study has been informed by the researcher's experience as both a fine art graduate and a support worker assisting people with autism. The researcher anecdotally recognised that there was a potential difference in how people with autism approached drawing an image, in particular an image of a face in comparison to typically developing people. There has been a considerable amount of research into how individuals with autism perceive the world around them (for example, Baron-Cohen, 1993). Although there does not appear to be a significant body of work linking autism and art, personal accounts written by people with autism (such as Wiltshire, 2015, and Grandin, 2005) often include references to their artistic

ability, as well as their creative thoughts and understanding regarding the visual world and how they portray and express themselves through art.

### **1.3 Autism and visual processing**

Individuals with a diagnosis of autism are considered to have a neurological pervasive developmental disorder, within a spectrum of abilities, and have difficulty with social interaction, communication and imagination known as the “triad of impairments” (Wing, 1988). Face recognition has been highlighted as a difficulty for individuals with autism, both personal accounts and academic literature, such as the work of Baron-Cohen and Bolton (1993) have highlighted face recognition as a difficulty for individuals with autism.

*It is often claimed that children with autism avoid eye-contact with others. However, studies suggest that children with autism simply look for shorter periods at everything, and not less at the eyes in particular. This may give other people the impression that they are ‘avoiding’ eye-contact, whereas in reality it may not be so deliberate. Nevertheless, there is something odd about their use of eye-contact (Baron-Cohen & Bolton, 1993, p. 44).*

It is suggested that individuals with autism often do not look at people’s faces as much as, or in the same way as, typically developing individuals. This may be reflected in how they draw a face. This small-scale study seeks to explore whether this is the case.

## 1.4 The perception of a drawn image

The perception of a drawn image differs in each of us, and there can be many ways to consider an image of a face and body:

- A documentation of one's appearance in a moment in time
- A visual metaphor of a personality.
- A visual metaphor of an emotional disposition.
- A collection of marks, which resemble, visually, a person

The researcher's background as an artist has offered the opportunity to both create and witness others create portraits. The researcher observed two patterns occurring in the portraits made by people with no artistic training. These are:

- some individuals will start with the head, and more specifically the inner face (commonly the eyes, nose and mouth), and then move outwards from there.
- other individuals will frequently draw the entire body first, or when drawing a face will draw from the outside, in a general order of head, ears and hair, and work inwards. Those with autism appear to follow this second sequence.

The researcher is aware that the way in which we draw may be explained as the consequence of taught approaches in art classes, as discussed by Stanyer and Rosenberg (2003). However, it is not clear if this can entirely influence the way one draws.

The researcher's observations suggest that when making figurative observation drawings, we draw what we notice first. For some, it may perhaps be the head and

more specifically the eyes and face; to others, it may be a foot, an arm or the overall body shape. When we draw with a trained hand, we learn tricks for structuring an image; for example, measuring or squaring up. Consequently, we adapt a learning style that overrides the unrefined way we had once drawn. This study is addressing whether the natural patterns of drawing appear in drawings of faces made by individuals with autism, and whether this differs from typical adolescents without autism.

### **1.5 Aim of the study**

The aim of this study is to explore how pupils with autism draw a face and whether there are any noticeable differences between pupils with a diagnosis of autism and typically developing pupils.

### **1.6 Purpose and potential significance of the study**

Knowing how someone with autism differs from a typically developing individual is likely to help educationalists design interventions that are more appropriate to their learning style. Gaining a better understanding of how someone with autism visually processes a face could help professionals and carers understand how they interpret facial expressions in others. Adapting interventions may help pupils struggling with typical learning aids to become more adept socially and academically.

This chapter has given an overview of the rationale for the study based on the initial observations made by the researcher. In the next chapter, the relevant literature will be reviewed and the key research questions given.

## **CHAPTER 2**

### **2. Review of the literature**

#### **2.1 Introduction**

This chapter reviews the relevant literature. It discusses differences in visual processing in autism and looks at the theoretical explanations. The chapter summarises current research that explores how people with autism draw, identifying current knowledge and methods of research. The chapter explores the literature, by explaining the searching strategies; which databases were used and presents the papers that were relevant to this study; the research designs of the papers, and identifies the main methods that have been adopted by others in the research of autism and visual processing. The chapter goes on to identify the prevalent theories that emerge from these studies, and discusses their impact on one another and how they sit within the context of autism and visual processing. Finally, the chapter concludes with the research questions.

#### **2.2 Searching the literature**

An initial literature search identified current scholarship, (which covered the period from 2006 to 2015) from the databases PsycINFO and MEDLINE, The search was based on the keywords autism spectrum disorders “OR” autism, visual perception and face recognition, (where “OR” was used to combine keywords). Several thousand results were offered based on title alone. Therefore, the results were refined by filtering and combining the studies into those that included all the keywords using the function “AND” in the database search as listed in Table 1 below.

<b>Table 1</b> Results of the literature search from PsycINFO and MEDLINE databases 2006–2015			
	Database	Keywords	Results
1.	PsycINFO	AUTISM SPECTRUM DISORDERS OR AUTISM	24,362 results
2.	PsycINFO	VISUAL PERCEPTION/ OR FACE PERCEPTION/ OR VISUAL DISCRIMINATION	49,238 results
3.	PsycINFO	FACIAL EXPRESSIONS/ OR FACIAL FEATURES	9,140 results
4.	PsycINFO	FACIAL RECOGNITION	517 results
5.	PsycINFO	2 OR 3 OR 4	55,317 results
6.	PsycINFO	1 AND 5	720 results
7.	PsycINFO	1 AND 2	573 results
8.	PsycINFO	Different limits were explored	
9.	MEDLINE	AUTISM SPECTRUM DISORDERS OR AUTISM	19,610 results
10.	MEDLINE	VISUAL PERCEPTION/ OR FACE PERCEPTION/ OR VISUAL DISCRIMINATION	50,200 results
11.	MEDLINE	FACIAL EXPRESSIONS/ OR FACIAL FEATURES	9,017 results
12.	MEDLINE	FACIAL RECOGNITION	396 results
13.	MEDLINE	10 OR 11 OR 12	58,235 results
14.	MEDLINE	9 AND 13	780 results
15.	MEDLINE	9 AND 10	507 results

The results from rows 6 and 14 include all the studies in relation to autism and visual perception/face perception/visual discrimination/facial expressions/facial features/facial recognition, which total 720 + 780 results. There was a large amount of overlap between PsycINFO and MEDLINE. The title and abstract from the first 190 relevant papers from both databases combined were explored in more detail, as saturation of the key emerging themes had been reached (Robson, 2002) at 190 studies. Exclusion criteria were based on participants and type of study.

The most recent studies focusing on facial recognition, comparative studies, and literature reviews summarising what is known and established in relation to autism and typically developing individuals were identified as the most relevant and of interest to this study. Papers relating to visual perception – such as face inversion, memory tasks and other object-related visual perception studies – were not included, as they were not thought to be as relevant to this study.

A second, more refined search of the 190 identified studies was conducted using the keywords autism and drawing; autism and drawing a face; global and local visual processing; eye gaze; weak central coherence; and enhanced perceptual functioning. The second search used the database PsycINFO only, and the results for each specific group of keywords are listed in Table 2 below.

<b>Table 2</b> Refined search from the PsycINFO database 2006–2015			
	Database	Keywords	Results
1.	PsycINFO	autism AND global AND local AND drawing	10
2.	PsycINFO	autism AND drawing AND illustrations	4
3.	PsycINFO	autism AND drawing	224
4.	PsycINFO	autism AND face	1,011
5.	PsycINFO	3 AND 4	10

24 results were procured from searches 1,2 and 5 (table 2), and explored in depth (full papers). 61 results (the aforementioned 24, plus 37 from the initial 190 papers)

were taken as examples to illustrate current thinking and have informed this study.

They are not intended to be exhaustive.

The themes and a summary of the results from the 61 papers are included in Table 3 below based on the research design categories suggested by De Vaus (2005).

**Table 3** Summary of 61 research studies explored and themes identified

Themes	No.	Sample Participants	Research approach	Design type	Method
1. Drawing	16	Infants 0 Children 2a; 3sena;4tda Adolescents 1a; 4tda Adults 2tda; 1td	Descriptive 14 Explanatory 2 Theory building 5 Theory testing 11	Longitudinal 0 Cross-sectional 12 Case study 4 Experimental 0	Observation cognitive perceptual tasks 0 / Drawing 16 F5 (F/LG 1) O12 (O/LG 7)
2. Global and local processing	15 2	Infants 0 Children 3a; 2atd; 1asen Adolescents 4atd Adults 2atd; 2asen <i>Literature review</i>	Descriptive 13 Explanatory 0 Theory building 6 Theory testing 7	Longitudinal 0 Cross-sectional 11 Case study 2 Experimental 0	Observation cognitive perceptual tasks 7 / Drawing 6
3. Weak central coherence (WCC)	8 2	Infants 0 Children 1a: 1atd; 2asen Adolescents 1atd Adults 2atd <i>Literature review</i>	Descriptive 6 Explanatory 0 Theory building 6 Theory testing 0	Longitudinal 0 Cross-sectional 4 Case study 2 Experimental 0	Observation cognitive perceptual tasks 1 / Drawing 5
4. Enhanced perceptual functioning (EPF)	6 2	Infants 0 Children 1a; 1atd Adolescents 1atd Adults 1atd <i>Literature review</i>	Descriptive 4 Explanatory 0 Theory building 0 Theory testing 4	Longitudinal 0 Cross-sectional 2 Case study 2 Experimental 0	Observation cognitive perceptual tasks 1 / Drawing 3
5. Eye gaze	17	Infants 3a; 2atd Children 6 atd Adolescents 0 Adults 5 atd; 2td	Descriptive 17 Explanatory 0 Theory building 9 Theory testing 8	Longitudinal 1 Cross-sectional 14 Case study 1 Experimental 1	Observation cognitive perceptual tasks 17 / Drawing 0
6. Face processing	29 2	Infants 1a; 2atd Children 9atd; 1asen Adolescents 3atd; 1td Adults 8atd; 5td <i>Literature review</i>	Descriptive 27 Explanatory 0 Theory building 18 Theory testing 9	Longitudinal 0 Cross-sectional 23 Case study 4 Experimental 0	Observation cognitive perceptual tasks 23 / Drawing 4
7. Top-down/ bottom-up processing	9	Infants 0 Children 2atd Adolescents 3atd Adults 2atd; 3td <i>Literature review</i>	Descriptive 9 Explanatory 0 Theory building 0 Theory testing 9	Longitudinal 1 Cross-sectional 7 Case study 0 Experimental 1	Observation cognitive perceptual tasks 4 / Drawing 5
<p>Key: Sample participants abbreviations a = autism td = typically developing sen = special educational needs (1 deaf) atd = autism + typically developing asen = autism + SEN <b>Please note:</b> A few studies are included in more than one theme or with multiple ages</p>			<p><i>Type of study:</i> <i>Comparative</i> <i>45 out of 61</i> <i>5 literature reviews</i> <i>2 case studies of infants with autism</i> <i>10 TD only visual processing tasks</i></p>	<p>Key: Observation cognitive perceptual drawing tasks F = Face O = Object LG = Local and global processing</p>	

### **2.3 Focus of the studies in Table 3**

All the studies reviewed used observation cognitive perceptual tasks as the method to explore how individuals with autism process visual information, with 39 studies including drawing tasks. These tasks usually involved the participants drawing objects or non-social stimuli like geometric shapes. The tasks identify the order of priority one places on visual stimuli. Table 3 illustrates that when theme 1 (drawing tasks) was used specifically, this tended to be in relation to objects rather than faces. 12 studies used objects to explore geometric shapes, whereas only 5 used faces. For theme 5 (eye gaze), no drawing tasks were used. These studies used eye-tracking technology and were looking at what was holding the attention of the participant. For theme 6 (face processing), only four studies used drawing, whereas 23 studies used alternative cognitive perceptual tasks.

Of the 61 papers reviewed, 12 were related to visual perception in the general population. However, 3 papers, looking at working memory chose participants at risk of having autism but who had not received a diagnosis. 2 studies were looking at emotional responses to the visual stimuli of faces. Although these studies have been used to give context, they are not discussed in depth, as they were not of specific relevance to the study.

## **2.4 Research design used in the studies in Table 3**

The research design was categorised according to those suggested by De Vaus (2005). Only 2 studies were explanatory studies which aimed to offer an explanation for how we draw. All the other studies reviewed were descriptive, and therefore observed and recorded rather than attempting to offer a theoretical explanation.

The majority of the studies reviewed used a cross-sectional design. 45 studies were comparative, with a sample of both autism and a group of typically developing or special educational needs participants ranging in age from infants up to adults. 2 case studies were specific to autism: 1 looked at only 1 infant child, while the other studied a larger group of children with autism.

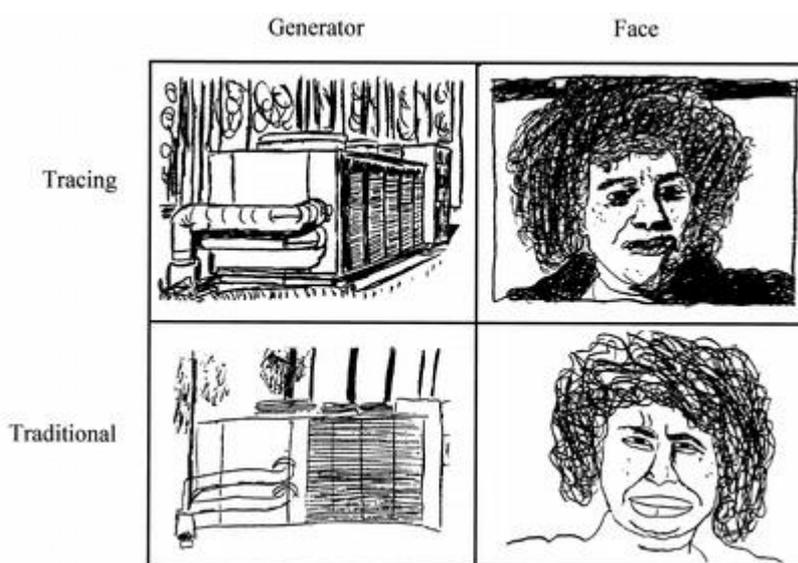
## **2.5 Summary of the areas researched from the literature reviewed**

The current study aims to ascertain whether there is a difference in how people with autism draw a face compared to typically developing (TD) individuals. The range of theories and arguments arising from the 61 papers which inform this work will now be discussed.

### *2.5.1 Visual processing when drawing in typically developing individuals*

Cohen and Bennett (1997) conducted a detailed analysis of how successfully typically developing adults achieve accuracy when drawing from a photograph. They tested four possible sources of drawing inaccuracies: misperception of the object;

inability to make good representational decisions; deficient motor skills; and misperception of the drawing. Their study recruited 9 TD adults, who were asked to trace and then draw a face and an electrical generator (illustrated in Figure 1). Their findings indicated that almost universally the tracing images produced more accurate replicas than traditional drawing from sight. They argued that this is because the artists' own interpretation of what they are seeing overrides the sensation of what they see. They concluded that the artists' misperception of the object is the major source of drawing inaccuracy, which will have implications that need to be considered when analysing findings of this study.



**Figure 1** Typical examples of renderings of the face and the generator in the tracing and the traditional conditions (Cohen & Bennett (1997))

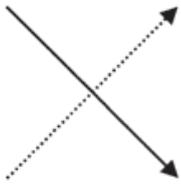
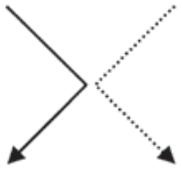
A study by Banerjee (2015) suggests that the level of attention given to what we see may be influenced by the observer's level of interest in the subject. This was a study of 24 TD adolescents aged 12–15 years, using spatial attention tasks of images,

such as sports, to record the levels of interest using electroencephalography (EEG). Banerjee concluded that the level of interest and anticipation influences motivation and stimulation of the sensory regions of the brain, also arguing that the brain functions across hemispheres may not be fully mature until late adolescence. The study details how we process visual information through what is described as “top-down bottom-up” processing. Therefore, there may be a link between their findings and the concept that top-down processing is stopping TD people from drawing what they see. How top-down bottom-up processing relates to this study will now be explored in more detail.

### *2.5.2 Top-down bottom-up processing*

Cohen (2005) explained that bottom-up processing is when an individual has no prior concept of what is being drawn. This study stated that top-down bottom-up processing could be understood as the influence of stimuli on the interpretation of and meaning given to a stimulus. The research provided a clear example of top-down processing from Van Sommers’ (1984) study, which is illustrated in Figure 2. The participants in this study were told that the stimulus was either a representation of two swords being crossed, or two mice sniffing; this then affected how they copied the image. Cohen (2005) concluded that the main reason most TD individuals cannot draw what they see accurately is due to bottom-up processing, as the influence of how they imagine a concept, such as a face, overrides what they actually see. The findings of both Banerjee (2015) and Cohen (2005) suggest that top-down processing impacts on TD individuals’ ability to process stimuli. Banerjee (2015)

suggested that this is related to the level of interest and anticipation, which then influences motivation and stimulation of the sensory regions of the brain.

Stimulus	Stroke Direction and Position	
	Crossed Swords	Two Sniffing Mice
		

**Figure 2** Van Sommers (1984) shows the influence of top-down processing when copying an image

This will be important when we consider how individuals with autism draw and whether they are using top-down or bottom-up processing. Bottom-up processing would enable them to draw more accurately, especially if they are less concerned about applying meaning, for example when drawing a face.

### 2.5.3 Visual processing and face recognition

*“Faces are the most important objects of sight. Not only do faces attract our attention more strongly than anything else does, but in our visual world there are no items that we see with so much alertness, discrimination and responsiveness” (Van de Vall, 2008, p. 50).*

While the above might be the case for TD individuals, there is a question as to whether the same is true for those with autism. A literature review conducted by Golarai et al. (2006) concluded that the human face is a focus of attention starting soon after birth, and typically developing babies as young as nine minutes old pay more attention to a face than to other visual patterns. Their review found that TD young children process faces differently to other objects. They suggested that this is due to the eye contact from others explaining that when a child recognises that they are being looked at, by meeting another person's gaze, then the area of the brain known as the amygdala, (which is associated with emotions, initiates a neurological response) which guides their eye gaze towards the eyes of the onlooker. Their findings also suggest that TD children focus on the eyes, nose and mouth of a face, allowing them to catalogue a range of emotional information, this nurtured an archive of stored information that employed daily interactions with others, which is important for early social development. Therefore, many of the studies understandably focus on how and why this might be different for individuals with a diagnosis of autism.

#### *2.5.4 Autism and visual processing of faces*

Understanding the basis of the impairment seen in autism and visual processing has generated a significant level of interest, as illustrated in Table 1 and Table 2 above. A study by Ashwin et al. (2005) focused on how individuals with autism process visual information in relation to held attention and how this may give some explanation as to why individuals with autism are thought to struggle with recognising expressions and emotions, which leads to an inability to recognise, or a delayed understanding of others' emotional states. Their findings supported the suggestion

that there is a difference in how individuals with autism process a face compared to TD individuals.

Chawarska et al. (2009) identified a clear difference in how toddlers with autism scan faces. Toddlers with autism scan their environment without bias between faces and objects whereas TD toddlers are drawn to focus on faces more than objects, which may encourage a deeper processing of socially relevant information. However the study is unclear on whether the participants with autism had an associated deficit in held attention level in relation to faces.

A study conducted by New et al. (2010) looked at the sensitivity of individuals with autism in relation to social attention when compared to a TD group. The study used two groups of eight participants, with an average age of 9.8 years old, to see what was registered when specific target objects (people, inanimate objects, animals, and plants) were removed from photographic images of natural scenes. They argued that the ability to prioritise between animate and inanimate objects in a static natural scene highlights the areas of visual difference when questioning whether objects dictate attention in the same manner as people and animals. They concluded that individuals with autism showed the same level of social attention for inanimate categories as the TD group. Their findings suggested that individuals with autism were processing the social scenes in the same way as the TD group and therefore any differences seen in autism are not due to the ability to scan an environment. They went on to suggest that the impairments seen in autism for specific social cues may not be a single phenomenon and that an impairment of visual processing of social cues cannot be supported.

An example of this difference seen in autism is the artwork of Stephen Wiltshire (2015), an individual diagnosed with autism, who has a savant artistic ability to recreate an almost perfect representation of a building that he has seen, but who does not include people in his drawings.

Another autistic individual, called Nadia (Selfe, 1977), created multiple images of a horse from a storybook rather than from a real-life example, which she is then able to draw in detail. Many of her drawings are almost photographic, although they are created from her imagination. These individuals are rare and are considered to have “savant” skills, which are not the focus in the majority of research studies because they are not representative of the whole population.

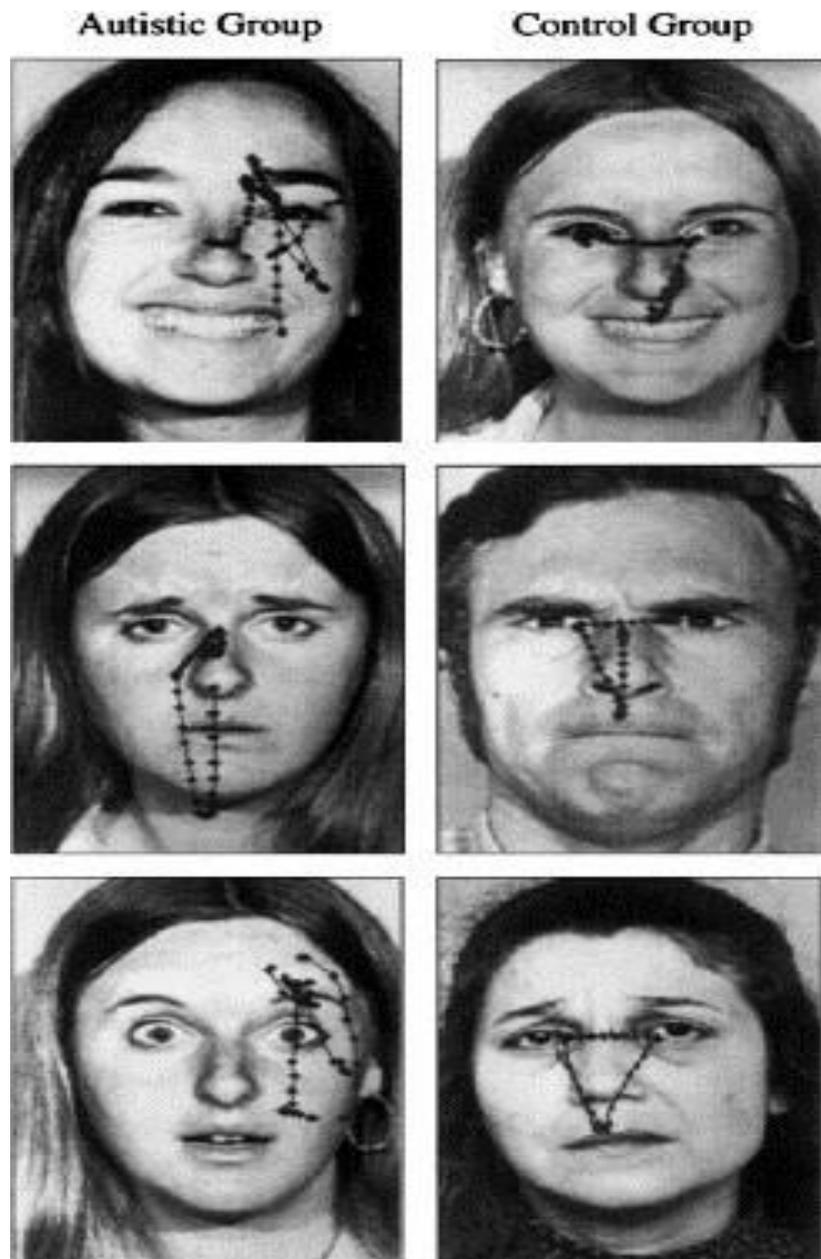
It appears that the visual processing differences found between TD individuals and individuals with autism relate to how visual information is prioritised by the brain. The following sections will discuss different aspects of visual processing in autism and in TD people.

#### *2.5.5 Eye gaze*

The relationship that people and objects hold over our gaze has helped researchers grasp where the differences occur and also presented opportunities to identify possible early indicators of autism. As an example, a study by Jones, Carr and Klin (2008) found that tracking eye movement means it is possible to show when infants as young as two years old are presenting behaviours associated with autism. They

argued that the level of fixation on eyes correlates to the social disability seen in autism.

As previously discussed, Golarai et al. (2006) suggested that TD children focus on the eyes, nose and mouth of a face, allowing them to catalogue a range of emotional information. This contrasted with the participants with autism, who spent less time looking at the inner features of the face, particularly the eyes, when compared to IQ matched controls. Figure 3 shows how the researchers used the following illustration from Pelphrey et al. (2002) to show this more clearly.



**Figure 3** Pelphrey et al.'s study "Visual scanning of faces in autism" (2002) (cited in Golarai et al. (2006)) outlines the comparison seen in the direction of the eye gaze for typically developing and autism participants

A number of the research studies reviewed by Dakin and Frith (2005) concluded that individuals with autism pay attention to different aspects of the world, and so see the world differently. By looking for typical and atypical visual scanning patterns in facial processing and general processing of an environment, robust evidence of atypical scanning in autism has been gathered. Dakin and Frith (2005) stated that they had found atypical global and local processing in individuals with autism. Global processing is described as the ability to holistically identify structures and shapes by looking upon stimuli as a whole. Local processing is the processing of detailed shapes within the holistic context, identifying and homing in on more specific fine details.

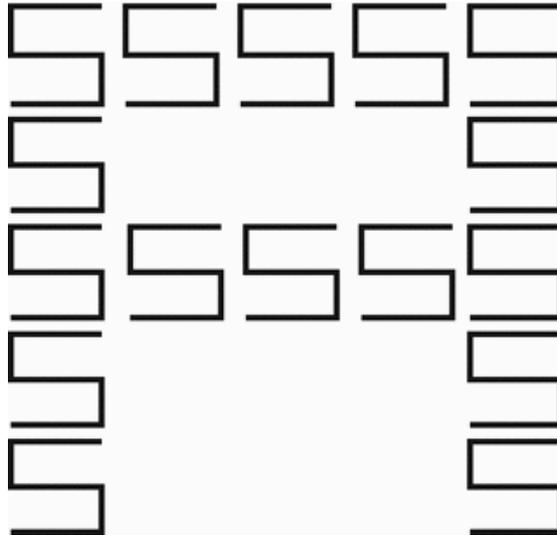
They suggest that the social deficit we see in autism may not result from an inability to prioritise social cues on a global level, but rather a more astute problem in local processing of facial stimuli. As mentioned before, Pelphrey et al. (2002) have established that TD individuals process detail by localising their scan to particular inner details of the face. Studies found in relation to eye gaze and eye tracking show that individuals with autism do not show a similar scanning pattern to TD individuals. Interestingly, it is worthy of note that there was a lack of research found in relation to eye gaze and global and local processing. The studies found in relation to global and local processing focused on visual processing in relation to objects, rather than face recognition.

## 2.6 Global and local processing

It is unclear how Pelphrey et al. (2002), interpreted the image used to illustrate the differences seen between the participants with autism and those without, and whether they would consider both groups to be using localised processing.

Mottron and Souliers (2006) offer an update to their original model known as Enhanced Perceptual Functioning (Mottron & Burack, 2001) which provides an alternative framework for understanding the perceptual characteristics observed in individuals with autism. They identified eight principles based on a review of the evidence provided from other visual perception research studies over a five-year period. As an example, Mottron et al (1999) used copying tasks to assess visual processing in 10 non-savant individuals with a diagnosis of autism. The findings presented were that at the start of the study the individuals with autism produced more local features when compared to the control group although there was no difference found in relation to graphic consistency.

A “Navon-type” stimulus is used by Mottron and Souliers (2006) to identify global and local processing. A Navon shape is a large recognisable shape created from smaller but different recognisable shapes, such as a letter, as illustrated in Figure 4. The holistic collection of the smaller S shapes, when processed in a global manner, forms a large A, whereas the smaller “S” is apparent with local processing.



**Figure 4** Example of a global versus local processing Navon-type stimulus test. Mottron & Souliers (2006), *Encyclopedia of Autism Spectrum Disorders* (pp. 1,445–1,451)

Eigsti et al. (2012) argued that a better understanding of visual processing can be obtained by looking at the global and local processing of participants ranging from TD individuals to those with autism and Williams syndrome. The literature review completed by Dakin and Frith (2005) evaluated the quality of evidence in relation to three classes of perceptual phenomena that have been associated with autism:

- Superior processing of fine detail (local structure)
- Either inferior processing of overall/global structure, or an ability to ignore disruptive global/contextual information
- Impaired motion perception (Dakin & Frith, 2005, abstract)

They argued that although there was robust evidence for superior local processing, there was a lack of evidence to support the theory of a weakness around global processing.

Continuing this theme, Kushner et al. (2009) found that there was no evidence of local processing superiority in autism when they attempted to reproduce an objective scoring system known as the “Rey–Osterreith Complex Figure” to examine local and global processing patterns associated with autism. Their study included 37 participants with higher functioning autism compared to a TD gender and age matched control group; the participants were then split into 2 separate age groups (8–14 years and 15–47 years). However, they did not include participants with lower functioning cognitive abilities and therefore were unable to generalise their findings.

More recent studies have contrasted with evidence that supports the previous findings from the literature review conducted by Dakin and Frith (2005). Neumann et al. (2011) suggested that there is evidence that individuals with autism engage in “*intact or superior local processing of visual-spatial tasks*”, with a potential to outperform TD controls in local processing. A study by Koldewyn et al. (2013) complements this theory suggesting that individuals with autism demonstrate a significant difference in global and local processing, and a tendency for a more local processing style. However, they boldly state in their title that “*ASD show a disinclination, not a disability, in global processing*”, so that global processing is overshadowed, with a bias towards processing local stimuli (Koldewyn et al., 2013).

WCC (Weak Central Coherence) is one of the prominent conceptual models for theories relating to autism on tasks involving global and local cognitive processes. WCC suggests that people with autism focus on detail, with a lack of drive to attend to global coherence. This has been understood as them being unable to perceive at a global processing level (Happé & Booth, 2008). Frith (1991) suggested that individuals with autism were more able than typically developing individuals to see the fine detail but had a tendency not to process information globally or holistically, which became popularised, although possibly misinterpreted, through the saying that they could not “see the wood for the trees”.

*We suggest that under some circumstances, autistic individuals can take advantage of parallel access to local and global information. In other words, autistics may sometimes see the forest and the trees, and may therefore extract from noisy environments genuine regularities which elude non-autistic observers (Perreault et al., 2011, abstract).*

These findings suggest a preference for detailed local processing and a deficit in global processing. The two strongest theories that attempt to explain the differences observed are weak central coherence (WCC) (Frith, 1989) and enhanced perceptual functioning (EPF) (Mottron and Burack, 2001). Both theories offer some explanation of the savant abilities which have been observed in individuals with autism in subjects like maths, engineering and art. The current study aims to add to the understanding of these two leading theories, which remain lacking in consensus.

## **2.7 Enhanced perceptual functioning and weak central coherence**

EPF also suggests that individuals with autism process local fine details effectively and that there is a stronger draw to local processing over global. Where the theory differs is that WCC suggests an associated weakness in global processing, whereas EPF does not. EPF suggests that there is no associated dysfunction in global processing, but that individuals with autism are unable to connect interrelationships effectively, which leads to an inability to put the information into context. This theory gives some explanation to the observation that some children with autism present as “hyperlexic” (Motttron et al., 2006). They can often read text very quickly, and some have savant skills relating to spelling and grammar, but lack the overall comprehension expected from their reading ability. These theories have led to the observation that individuals with autism are thought to have narrow but deep understanding of subjects and interests.

However, there do appear to be some gaps in the literature in relation to visual processing and our understanding of autism. For example, the majority of the studies found were testing global and local processing by studying how participants draw objects or geometric shapes. Happé and Booth (2008) also suggest that the studies explored in their literature review are not designed to test global and local processing effectively. They state that many studies do not equally test both global and local processing; instead, they ask participants to choose between which they would use first, and then conclude that the less favoured way of processing is inferior or disabled. Happé and Booth (2008) express that only when research has been able to test for measures of both local and global processing will a solid hypothesis be able to be drawn in relation to weak coherence.

Another similarly vague area in the literature are studies that use objects or geometric shapes, which do not make it clear how they can be replicated, or how their findings can be generalised and transferred into an understanding of how people with autism see and draw a face. The majority of studies looking at facial recognition use different tasks and tests, such as eye tracking. Although studies looking at global and local processing use a drawing task to identify participants' processing, this method of data collection is not carried over when research is studying faces and global and local processing. Instead, eye-tracking tests are preferred. There did not appear to be any studies that had an overlap between visual perception methods of collected data and face recognition. However, this study is particularly interested in how these theories relate to how we process a face and whether drawing tests of faces will generate similar findings to those of research using objects.

## **2.8 Drawing and visual processing**

The majority of studies found focused on the processing of objects or abstract stimuli to test the participants' use of visual processing. When focusing on papers using drawing in their data collection, many studies looked at global and local processing, but also the theory of "top-down bottom-up" processing.

This is important when looking at how individuals with autism draw, as previously discussed. Banerjee (2015) suggests that the level of interest and anticipation influences motivation and stimulation of the sensory regions of the brain. However,

the established theories of autism suggest that individuals with autism do not usually show a high level of interest in faces. Therefore, a suggestion could be that individuals with autism will be less likely to be using top-down processing and more likely to be using bottom-up processing. This would result in more accurate drawings, as they are less concerned about applying meaning. This would concur with WCC and EPF, as both these theories suggest a bias towards fine detail and local processing. This distinction might be tested if a comparison is made between TD individuals' drawings of a face and those by individuals with autism.

A study by Shepherd et al. (2007) supports this argument. They found that young people with autism were less affected by the need to find meaning when given a drawing task that involved copying line-drawn images. This study was interested in comparing WCC and EPF theories. Their conclusion was in support of EPF as a way to understand the processing differences seen in autism in relation to global and local processing. Furthermore, Chamberlain et al. (2013) also found a relationship between global and local processing and how art students with autism draw. Their findings were in support of EPF and suggested a filtering of global information rather than a reduction in global processing. They also suggested that their findings have implications for bottom-up and attention theories as well as offering an explanation for special skills seen in autism. However, Drake and Winner (2011) explored WCC and EPF in a qualitative case study looking in depth at how an individual child with autism drew animals. They concluded in favour of WCC, reporting evidence for superior local processing. These studies highlight the inconsistencies between research papers, emphasising a need for more research in the area. As previously identified, an area of the research that has not been thoroughly explored is global

and local processing in individuals with autism using drawings of faces. Only a small number of studies found focused on this.

## **2.9 Autism and drawing a face**

The majority of studies that used portraiture employed them as an interaction aid, an educational task or a way of developing social understanding, rather than a way of exploring how people draw faces. These studies are thus not relevant to the current study and have not been included in the review.

One recent study of particular relevance is that by Meaux et al. (2014), written up in their paper entitled, "Please draw me a face". The sample included 33 children divided in to three groups. Group 1 consisted of 9 boys and 2 girls with a diagnosis of autism. Group 2 consisted of 2 boys and 9 girls who were congenitally deaf. Group 3 were a control group matched on developmental age consisting of 8 boys and 3 girls. Each group was asked to draw a face without any specific further instruction. The choice and order of the features were noted and ten elements were identified for analysis including facial and non-facial features such as glasses and jewellery. Their study aimed to understand how children with autism conceptualise and mentally picture a face. In their literature review, they found substantial research on global and local processing of individuals with autism but stated that there was a lack of research on the mental representation of faces in autism. Their study aimed to shed light on whether atypical sensory processing has any significant effect on how a face is conceptualised, and to explore how much of an effect, if any, these abnormalities might have on the cognitive and social impairments seen in autism.

They argued that the results may show a preference for global as opposed to local processing, which challenges WCC theory and adds additional support to the EPF model proposed by Mottron and Souliers (2006) as an alternative perspective.

The current study has been influenced by the most recent literature available in relation to visual processing. Of particular interest are the findings from Meaux et al. (2014) and the EPF model proposed by Mottron and Souliers (2006). This study will focus on visual processing in relation to drawing faces rather than objects and aims to add to the knowledge and understanding of how individuals with autism process visual information. This study will be designed to allow for a small-scale comparison between individuals with autism and TD participants.

## **2.10 Summary of the chapter**

This chapter summarised the key literature and discussed the differences in visual processing that have been found between individuals with autism and TD individuals, as well as some of the theories that have developed to support these. All the studies reviewed used observation cognitive perceptual tasks such as being asked to draw objects and shapes, which are designed to identify what someone is thinking when they are processing what they see and notice, and what they are aware of on a cognitive level while completing the task. Many used drawings of objects or geometric shapes, and only 5 of the 61 studies reviewed asked participants to draw faces. Similarly, of all the studies (n=27) on face processing, only 4 used drawing; the other 23 used alternative cognitive perceptual tasks, such as noticing what objects had been removed from a photograph or image. Most of the studies

reviewed were descriptive, using a cross-sectional design, and there were only 2 explanatory studies offering an explanation as to how people draw faces. Over half the studies reviewed were comparative studies, and there were just 2 case studies.

From the studies reviewed, it could be noted that unless the participants were offered the opportunity to give feedback from their own perspective, the findings may be subjective and based on the researcher's perspective rather than the participant. This may therefore not be a true representation of how the individual experienced the task. The researcher acknowledges that the voice of individuals with a diagnosis of autism is important when researching about autism.

This study attempts to explore visual processing through drawing an image of a face. The research questions based on the literature are as follows.

### **2.11 Research questions**

There are two main research questions, as follows:

- 1) Is there a pattern in how pupils with autism draw a face in terms of the features and details drawn and the order in which they are drawn?
  
- 2) Are there differences between how adolescents with autism and TD adolescents draw a face?

The next chapter discusses the research design, the research methods and the sample recruited to explore these questions.

## **CHAPTER 3**

### **3. Methodology and sample**

#### **3.1 Introduction**

This chapter discusses the research design, methods employed and the ethical issues that arose. It includes how the participant sample was selected and recruited, and gives details of the pilot study and data analysis.

#### **3.2 Research design**

The most appropriate design for this study was considered to be an empirical, qualitative case study. This allowed flexibility and is recognised by Yin (2009) as a useful approach for researching complex social phenomena. The study was observational and used a typology framed within a pragmatic perspective that was influenced by current research literature in relation to mixed methods (Creswell, 2014), artistic enquiry and artistic dialogue (McNiff, 1998). Artistic enquiry refers to research where artistic practices such as drawing or painting are used as the method of collecting and generating data (McNiff, 1998). Artistic dialogue refers to research where the process of making the artwork is used in the form of a dialogue to give an account of the process and document how the work was created, rather than using the aesthetic outcome, such as the finished artwork (McNiff, 1998).

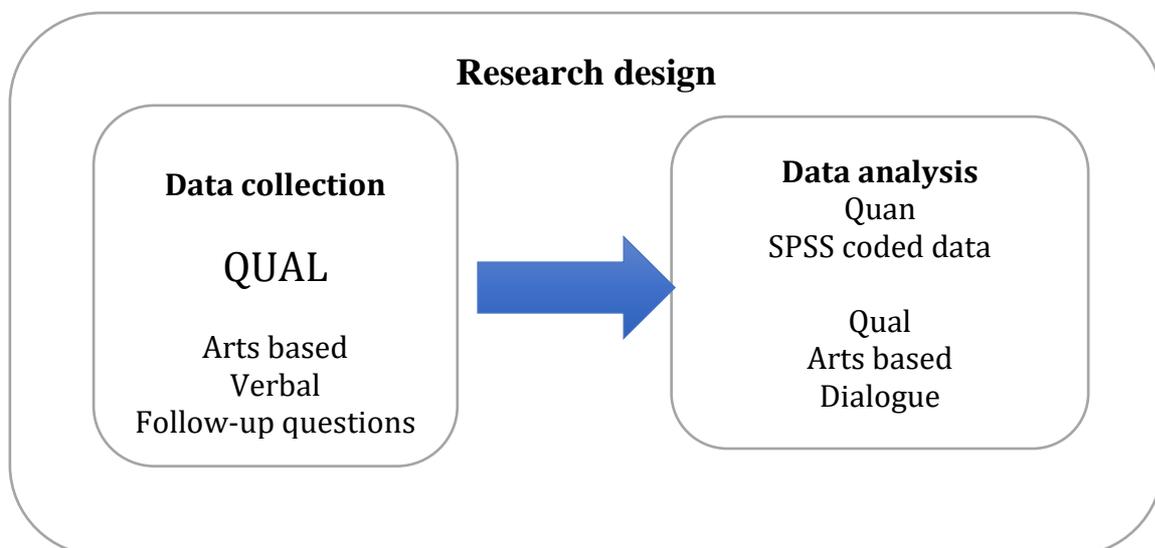
Pragmatism as defined by Creswell (2014) is a world view that is not limited to any one philosophical view which has arisen from actions, consequences and situations.

A pragmatic approach to research, known as mixed methods, offers the choice of different techniques, methods and procedures associated with both quantitative and qualitative research to best fit the needs and purpose of the study as part of the research design. Quantitative research has generally been associated with the paradigm known as positivist or post-positivist. Researchers tend to be mindful of the importance of objectivity and the need to avoid affecting the results by their own presence while conducting the study. This is to avoid bias and ensure the validity of the findings. It usually involves data coded into a numerical form in order for factual statistical calculations to be made, which allow for conclusions to be drawn.

Qualitative research, on the other hand, adopts an approach that is generally associated with the social constructivist paradigm. This usually has an emphasis on the nature of reality being socially constructed and makes an attempt to draw meaning from human behaviour, experience and beliefs. There tends to be less emphasis on the need to generalise the findings, with the intention being to gain rich and complex understandings of people's experience that could be used to develop a theory or establish a pattern through an inductive approach.

There are benefits in combining quantitative and qualitative research approaches so that the advantages, strengths and similarities of each are combined (Anthony et al., 2005). Onwuebuze and Teddlie (2003) de-emphasise terms such as qualitative and quantitative and have instead conceptualised exploratory and confirmatory methods that aim to unite qualitative and quantitative approaches under one framework. They suggest that a better understanding of a phenomenon is gained when using systematic, coherent and collaborative methods from a pragmatic perspective, arguing that this allows for a more holistic endeavour.

The current research study was designed primarily within a qualitative paradigm. This is illustrated below as QUAL from Creswell and Clark (2011), with the raw data being collected through drawing tasks. The data was then coded and analysed numerically using SPSS software, which is a quantitative research approach. Follow-up questions were used to gain further feedback from the participants from their own perspective. Arts-based dialoguing of the process, as described by McNiff (1998), was used within the analysis.



**Figure 5** Visual representation of qualitative and quantitative components within the research design (Creswell & Clark, 2011, p. 70)

### 3.2.1 Piloting the study

A pilot study was conducted to test and develop the methods in order to identify the best approaches to use when communicating verbal instructions to each participant, and test the tasks in a practical context.

### 3.3 Piloting the study

Seven individuals – four with a diagnosis of autism and three typically developing participants, who were between 12 and 23 years old – were selected from individuals attending a local autism social group for the pilot. The participants were asked to draw five different faces. Specific feedback from the participants included that they found drawing a cartoon more enjoyable than other sources. This encouraged engagement and motivation in the task. It was decided that the self-portrait image would be best suited as the final task rather than at the beginning because participants were less reserved at the end.

The feedback also gave the researcher guidance on how much verbal and non-verbal prompting was helpful, and identified necessary environmental changes such as preparing the workspace before the participant entered the room. The participants were distracted by notes taken on a laptop and said that they were aware of the keys being tapped and that notes were being taken. So, handwritten notes were used rather than a laptop during the research study.

It was also noted that participants who understood the purpose of the study became distracted and overthought their drawing processes, thus it would have benefitted the

students not to have known what the researcher was analysing when they were drawing their images. As a result, the participants in this research were not told the purpose of the study until after they had drawn their 5 images and answered all the questions. They were informed that the aims of the study would be explained after the tasks and that any questions they had about the purpose of the tasks would be fully answered.

### **3.4 Selecting the participants for the main study**

The target population of the study was individuals with autism, but a comparison group of TD children was also recruited. They were all pupils in mainstream secondary school aged between 11 and 16 years old. They did not have comorbid learning difficulties or any other diagnoses and they all spoke English as their first language. Although all the participants were likely to have had a brief education in drawing, none had yet received an advanced education in art or illustration. A total of 14 participants took part in the study. Seven children with autism were selected, as well as a comparison group of seven typically developing pupils all selected and matched to have a similar level of intellect as judged by their teachers from their academic work in school. The diagnosis of the participants with autism could not be checked by the researcher, and so their diagnosis taken as stated on their school records. Details of the 14 participants are given in Table 4.

<b>Table 4</b> Details of each of the children involved in the study		
<i>A = Autism</i>		
A	Age	Gender
Participant 1	13	Male
Participant 2	13	Male
Participant 3	16	Male
Participant 4	14	Male
Participant 5	12	Female
Participant 6	16	Male
Participant 7	15	Female

<i>TD = Typically developing</i>		
TD	Age	Gender
Participant 1	15	Male
Participant 2	14	Female
Participant 3	14	Male
Participant 4	15	Male
Participant 5	14	Male
Participant 6	13	Male
Participant 7	16	Female

### **3.5 Ethical issues**

The study received ethical approval from the University of Birmingham before any participants were invited to participate. (see Appendix 1 for the research methodology, information sheets, invitation letter and consent forms.) The pupils were selected from two secondary schools: one in Wales and one in England. The head teacher and school staff identified participants who were appropriate based on the criteria set out in the information sheet for the schools. Each pupil was contacted

by their school and invited to participate in the study. A covering letter and information sheet explaining the outline and purpose of the study, expectations of the participants and confidentiality was sent to parents/guardians via the head teacher. The researcher did not contact the participants directly until the consent form had been completed. The participants were under the age of 18, and therefore in addition to them giving their consent, their parents/guardians also needed to sign the consent form.

The school staff determined when and where the research took place and created the schedule for the participants involvement in the research. A school staff member was present when undertaking the research to ensure that each participant was supported and comfortable in the environment. The researcher also had a current DBS certificate. All data collected was anonymised and stored securely as described in the information sheets provided. Accessibility was restricted to the researcher and the independent interpreter of the SPSS coded data.

### **3.6 Reducing bias**

The researcher interpreted and coded all the data. Inter-rater reliability was established by a second independent rater who analysed a sample of 10 video recordings from 14 participants. This included 5 from the autism group and five from the TD group. The independent rater made his own notes and coded the data following the criteria set out in more detail in Chapter 4, under analysis of the data.

The researcher was a qualified fine art degree graduate and an experienced support worker for individuals with autism, whereas the independent rater was not a trained artist and had never worked with individuals with autism. The researcher might have been biased in the analysis due to his knowledge of autism and visual processing. The independent rater had no experience of supporting individuals with autism or of the theories of autism. It was hoped that this difference in world view and life experience would reduce the bias and strengthen the reliability of the study's data.

### **3.7 Research methods**

All participants were asked to draw 5 pictures of faces from 5 chosen sources. These were either memory based, or drawn from a model or a photograph. The drawing of the image was recorded using a video camera, while the researcher made hand written notes. The video recordings documented the order in which participants drew each feature, along with any corrections made. The amount of detail that was given to each feature and the time that was taken to draw each image was also captured. Follow-up questions were recorded on the same camera using audio recording only. Copies of the drawings were kept by the researcher for later analysis.

The order of the tasks was as follows:

1. A face from memory
2. The face of a life model (a teacher)
3. A cartoon face from memory
4. A face from a photograph provided
5. A self-portrait of their face using a mirror

### *3.7.1 Materials*

The participants were all provided with a pencil as the medium. This was felt to be the simplest tool with which to draw. HB pencils were identified as a universally understood medium, as they are likely to be the most familiar to all students and they do not introduce variables of how skilled a student is at using them. An HB pencil was favoured over a pen due to the permanency of the latter medium; the researcher tried to reduce anxiety for the students by allowing them to use a rubber. A pencil sharpener was also available to try to reduce any anxiety or pressure around creating the image. All illustrations were drawn on a standard A4 sheet of paper, with one illustration per sheet. Appendix 3 gives the full list of equipment used. A challenge for the researcher was to try to uncover the natural way that each student processed the face and not to be influenced by how schools have taught students to do this.

### *3.7.2 Images*

The participants were asked to draw 5 faces from 5 different sources, which were selected to capture varying drawing styles and to encourage the participants to draw outside of their usual comfort zone or learnt drawing techniques. The rationale for asking them to draw five images was that it was a way of strengthening the data, as it would allow any patterns to emerge. Each participant was given 5 minutes to draw each image. This allowed the research to be structured to fit a 45-minute slot per participant, enabling this to fit around the class timetables and mirror the familiar setting of the two schools.

The images comprised different people of varying ages and genders. There was no repetition of the same face, to a participant as this had potential for participants to fall into the same drawing routines, and to lose engagement with the task. Therefore, each image needed to be drawn spontaneously, without participants overly considering it.

#### *3.7.2.1 Drawing a face from memory*

The first image the participants had to draw was a face from memory. Asking the participants to do this meant that the resulting image would be fresh and with no previous influences or drawings to reference or copy from.

#### *3.7.2.2 Draw the face of a life model (the teacher)*

The second image the participants had to draw was the face of a life model (their teacher). Drawing a portrait of another individual had the potential to be the most difficult image for the participants to draw.

#### *3.7.2.3 Draw a cartoon face*

The third image that the participants drew was a cartoon face. From the pilot study, participants fed back that they enjoyed this task the most, and it therefore boosted both their attention and their enjoyment of the tasks overall. This was placed in the middle of the sequence to allow the researcher a quick comparison with the previous two images to see if there was a favoured style of drawing that the child was using

repeatedly, for example animé. The researcher could then address this if needed – for example, by encouraging a child to move away from using animé consistently.

#### *3.7.2.4 Draw a face from a photograph*

The photograph was the only source repeated for all 14 participants. Images drawn from the photograph reduced the variability across the sample, allowing comparisons to be made more easily.

#### *3.7.2.5 Draw a self-portrait of their own face*

The final image was a self-portrait. The pilot study suggested that this was the task that most participants had to dedicate the most attention to, as after this image was drawn, participants often lost interest in the remaining tasks, and this affected the quality of their other images. It was therefore decided that this image was best placed last.

#### *3.7.2.6 Rationale for the participants to produce line drawings over other art styles*

The study encouraged the students to adopt a line-drawing style using an HB pencil, for ease of coding the features later in the research. The use of lines separated the features clearly, and it was easier than other styles for identifying when a student had started and finished drawing a facial feature. It was also for this reason that the images were drawn in monochromatic, as it made images simpler and therefore

easier to code. The participants were not allowed to add colour to the images, because it allowed students to adopt different artistic styles, e.g. smudging, colour layering or block colours. This could have altered the results of the study and made it more difficult to ascertain the beginning and end of a drawn facial feature.

### **3.8 Procedure**

#### *3.8.1 Research setting*

Step 1: Setting up the room before the participant arrived

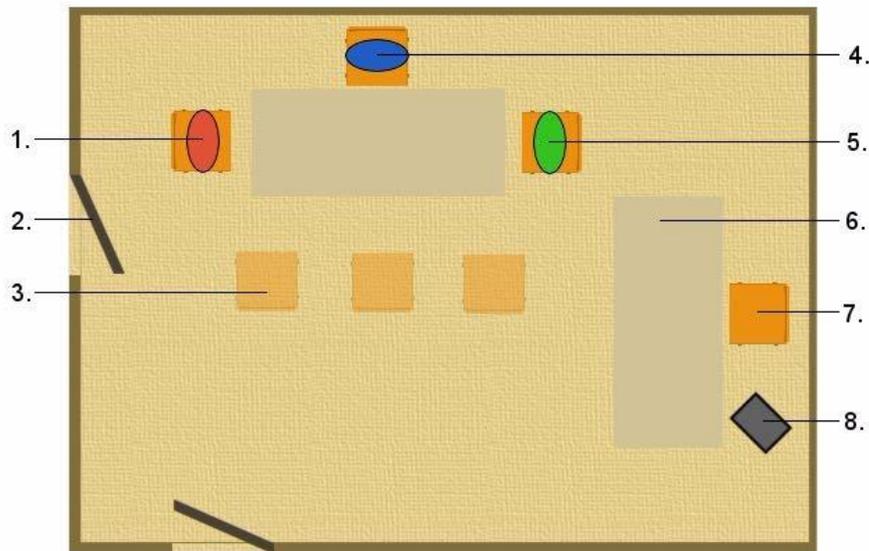
The aim was to facilitate a low-arousal environment to increase each participant's capacity to fully concentrate on the activities despite the presence of the researcher. An attempt was made to declutter the environment and reduce the amount of background noise.

The low-arousal approach, as described by Nguyen (2008), involved making sure that all possible sensory disturbances were minimised. Due to the participants being accessed via secondary schools, the study took place in four different rooms in two different schools. This was to fit in with the teachers' timetables and the availability of the rooms. All four rooms were study areas around 3 metres x 3 metres in size.

The first step taken to reduce possible sensory sensitivity to sound was to turn off any computers in the room. Computers on standby were fully turned off, minimising background light and hum. To further reduce sensory disturbances around lighting,

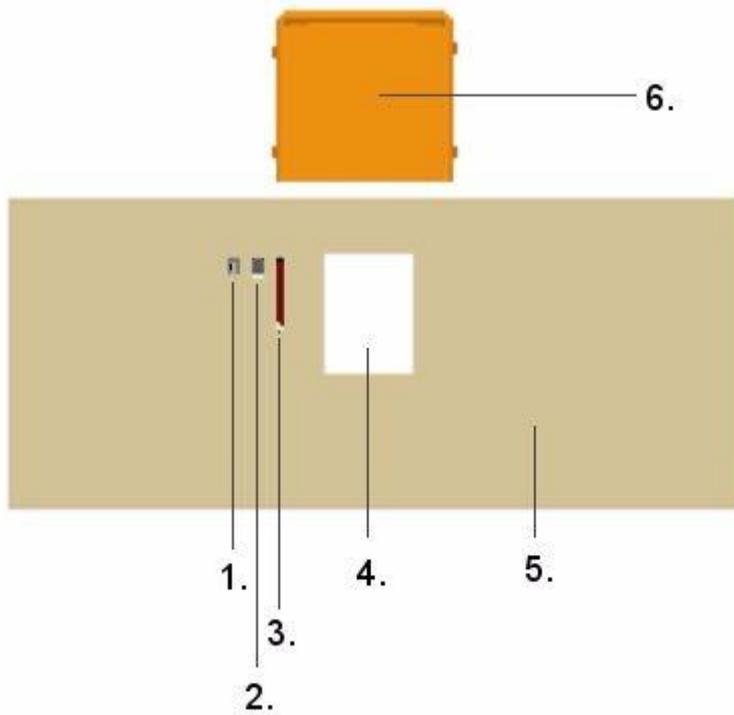
only natural light was used. Windows were uncovered but closed to reduce distractions from outside noise. Interior lighting was turned off if not required. The room was cleared of clutter by removing any objects from the workspaces, with only the objects needed for the study accessible. All of the rooms were decorated with posters on the walls. Consequently, the tables were moved to face the wall with the least sensory stimulation, and any posters that could be taken down were removed with the consent of the teacher present. The tables were moved so that the students' backs would be next to the wall, with the intention of reducing anxiety around exposure in the environment and to ensure that there was no one behind them during the tasks.

The workspace was set up with the prescribed equipment on the table, with a layout of one pencil, one rubber and one sharpener next to six sheets of A4 paper (see Figures 6 and 7). The tripod, camera and mirror were partially hidden, as the pilot studies suggested that it may be daunting to present these as the participants walked into the room. These were removed from the line of sight of the student and were easily accessible to the researcher when needed.



**Figure 6** Room set-up for the study

Key	Figure 6
1	Model/teacher
2	Door
3	Possible chair location
4	Participant
5	Researcher
6	Table
7	Chair
8	Camera location on participant's entry to room



**Figure 7** Illustration of the table layout

Key	Figure 7
1	Sharpener
2	Rubber
3	Pencil
4	A4 sheet of paper
5	Table
6	Chair

Before the teachers collected the students, they were briefed on the structure of the activities. They were informed on how the tasks were going to unfold and what the researcher needed them to do.

### *3.8.2 Step 2: Welcoming the students into the research setting*

The second step of the procedure was when the student entered the room with the teacher. The researcher was introduced and the student was shown where they could sit. The students were given the option to move the teacher's chair so that they could control where the teacher was sitting. It was hoped that this enabled the participants to feel more comfortable in the room and to control how close or how far away they wished the teacher to be.

After the camera had been set up, the researcher explained that he would also be taking notes as well as using the camera. The researcher asked if the student had a preference for where the researcher was positioned when they drew. If the participants needed an example, the researcher would provide one, such as, "Would you prefer me to be behind you or in front of you?" or "Would you prefer me to be seated or standing?" The researcher also reminded the students that they could change where the teacher sat, by moving the chair to be closer or further away. The researcher only suggested this if they felt that the student was anxious about the set-up of the room or about the researcher's positioning.

They were then thanked for agreeing to take part in the study and told that they could ask any questions at any stage. If the researcher felt that the student was particularly anxious, then the researcher would restructure the interaction to make sure that the participant understood that they were not being marked for their work. Equally, the researcher assured the student that there were no right or wrong

answers and encouraged them to say if the environment or tasks were stressful in any way.

### *3.8.3 Step 3: Undertaking and recording the tasks*

Before each participant began the tasks, the researcher explained which illustration they were about to draw. This is fully explained in the scripts in Appendix 3. The researcher talked the student through each task. The researcher made sure that the student had fully understood the request by encouraging them to ask questions about what was expected. The students were reminded that they would have five minutes for each illustration.

To ensure anonymity, it was important that only the student's hands appeared in the video recordings. While the student drew, the researcher was mindful of whether they were leaning over the image as they created it, and he would either instruct the student to allow for space so that they did not obstruct the camera, or adjust the zoom to enable a better recording of the drawings. After the five minutes had finished, the camera was turned off and the recording of the image would stop. This was a clear marker to stop drawing and helped save the battery life of the camera.

### *3.8.4 Step 4: Follow-up questions*

After the student had drawn all five images, the researcher asked two follow-up questions. To help the students feel more expressive and at ease, the researcher began by talking about the images that they had just created. The researcher

commented on the cartoon character they had chosen to draw, or asked who they had chosen to draw from memory.

The researcher then asked two follow-up questions, and each participant was given a total of 10 minutes to answer them. This was so as not to influence the students while they were engaged in drawing.

The questions asked were:

*1) When drawing a face, are there any areas that you consider more important to the image than others?*

This question was designed to look at what features are felt by the students themselves to be the most important and whether some features are more important than others. This question sought to uncover if students saw a deliberate hierarchy to facial features and whether they had an awareness of how they constructed a facial image.

*2) When drawing a face, are there any particular details that you spend more time and effort depicting?*

The aim of this question was to identify if there were any features that individuals felt required more effort or focus. This may have been because the participant thought they were harder to draw or because they thought it was more important to draw certain features more accurately.

The researcher was mindful about the order in which the questions were asked, and participants were given the opportunity to present their views on how they felt they constructed their images. Flexibility was important, as it was not known where the answers would lead and whether the questions could be fully understood by both pupils with autism and typically developing students. The researcher therefore employed some flexibility to restructure the phrasing of some questions if necessary, and could talk the students through what was being asked of them in order to help them answer the questions fully and ensure the questions remained student centred.

#### *3.8.5 Step 5: Student debrief*

In this final stage of the procedure, the researcher reminded each participant what the purpose of the study was. All documentation had finished and the purpose of the interaction was to reassure the participants and satisfy their curiosity about the study. The researcher thanked the participants for their help. The researcher explained that the aim of the study was to compare the drawings of individuals with autism with those of typically developing participants, to see if there was a difference in how they constructed an image of a face. The researcher said he did not know what the outcome of the study would be. The students were free to lead the conversation and were invited to ask questions. The researcher did not continue the conversation if they were not interested in asking about the study.

### *3.8.6 Notes taken by the researcher during the drawing process*

The handwritten notes of the researcher documented the order of each feature, the apparent amount of interest shown by the students in the tasks and how often they looked at the source of what they were drawing. A comprehensive account of the researcher's considerations has been included in Appendix 3. The notes documented during the tasks were recorded by hand in a notebook to enable the researcher to take notes quietly during the tasks. This information formed raw data and was used as part of the analysis.

The next chapter presents the data and findings from the 5 drawing tasks, highlighting the similarities and differences seen between the two groups.

## **CHAPTER 4**

### **4. Findings and discussion**

#### **4.1 Introduction**

This chapter explains the methods used to code and handle the data and outlines the process of data analysis, how the recording of the features was undertaken and how the features were coded. It explains the coding system used to determine the detail of the features drawn.

#### **4.2 Checking the reliability of the coding**

To check on the reliability of the data, inter-rater reliability was established by an independent person, who was given the raw video data from 10 videos (5 from each group) to test out the coding of the following:

1. The order in which the features of the face were drawn.
2. Definitions of what was understood as a feature.
3. How to document corrections.
4. A definition of the level of detail.

The total features identified for inter-rater reliability were reduced from the raw data of 35 to 23 and finally coded into 10 themes, which will now be explained in more detail.

### **4.3 Defining the features to be analysed**

A large amount of data was gathered by the study. The researcher had made intricate recordings of each of the six image components – for example, identifying which of the two eyes, which of the two ears and which of the inner eye details were drawn first. As a result, this made the data unnecessarily complex and meant that it was difficult to arrange the data into themes for analysis. This would have demanded a complex data analysis method; therefore, the definition of a feature was reduced to allow for a more workable data set.

Based on the observations recorded on video of the drawn faces, as well as the actual images themselves, decisions were made about which features were most prominent to be included and how each concept was defined. These definitions were considered the key features of the drawings. They encapsulated the predominant features, such as the eyes, nose and mouth, as well as other points of interest that were regularly drawn in the students' images, such as beards and cheeks. This decision was made through an informed understanding of which feature had been consistently drawn, by "eyeballing" the raw data.

A total of 35 features were identified from the raw data collected, as illustrated in Table 5:

<b>Table 5</b> Full list of features documented from written recordings during participant observations		
1. Left eye	14. Lips	25. Glasses left
2. Right eye	15. Teeth	26. Body
3. Right eyebrow	16. Chin	27. Right arm
4. Left eyebrow	17. Freckles	28. Left arm
5. Left eyelashes	18. Dimple	29. Right hand
6. Right eyelashes	19. Forehead wrinkles	30. Left hand
7. Right pupil	20. Left ear	31. Outer face
8. Left pupil	21. Right ear	32. Legs
9. Right iris	22. Beard	33. Cheeks
10. Left iris	23. Neck	34. Cartoon animal details
11. Bridge of nose	24. Glasses right	35. Hair
12. Nostrils		
13. Philtrum		

For the sake of ease and in line with contemporary studies (Meaux et al., 2014), the features were then reduced to a more simple and manageable data set of 23 features. For example, “nostrils” and “bridge of nose” were reduced to the feature “nose”, as illustrated in Table 6 below.

<b>Table 6</b> The reduction of features from 35 to 23		
1. Left eye	9. Hair	17. Body
2. Right eye	10. Left ear	18. Arms
3. Left inner eye	11. Right ear	19. Hands
4. Right inner eye	12. Chin	20. Legs
5. Left eyebrow	13. Outer face	21. Specific detail
6. Right eyebrow	14. Beard	22. Teeth
7. Nose	15. Neck	23. Cheeks
8. Mouth	16. Glasses	

For the purpose of handling the data, the 23 features were further reduced to the ten most frequently drawn features of the images. These ten features could be

compared in order to identify the linear order in which they were created. Features external to the head, such as the arms and legs, were grouped into a general coding of “the body”, which encompassed all features below the head, as illustrated in Table 7 below. This was justified, because the study’s focus was only on facial features.

<b>Table 7</b> The reduction to ten features		
1. Eyes	5. Hair	8. Inner eyes
2. Nose	6. Outer face	9. Body
3. Mouth	7. Glasses	10. Beard
4. Ears		

#### **4.4 Coding the features to be analysed**

##### *4.4.1 Recording of partially completed features*

For each of the five tasks, the features of the faces drawn by the participants were recorded. However, sometimes participants stopped drawing halfway through a feature. If the participant stopped during the drawing of a feature, or the time ran out, the researcher either:

1. Rounded the image up; if the feature was nearly finished, this was recorded as a “simple image”.
2. Rounded down; if the feature had only just been started, this was recorded as the “start of a feature”.



**Figure 8** The depiction of some hair that was half completed, and was therefore rounded up as a “simple image”



**Figure 9** The depiction of some hair that was recorded as the “start of a feature”

Extra time allowance could have been given in the case of an interrupted or unfinished drawing (i.e., a drawing where evident features were lacking (this was when at least three or four features were not present)). In this instance, an estimated period of one minute would have been made available for the participant to continue an unfinished drawing. This period was deemed appropriate, as it allowed for participants to make further drawings unprompted, but it was a short enough time to limit the potential for the participant to feel stressed. However, none of the 14 participants in this study needed to be given extra time.

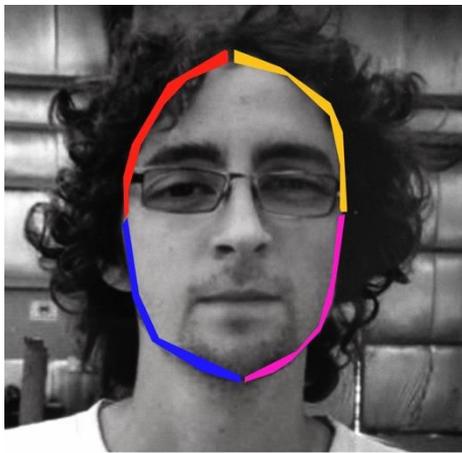
<b>Table 8</b> Example of how the data was recorded for each of the five tasks. The areas highlighted in green show how the order of the features was recorded.		
<b>Order</b>	<b>Corrections</b>	<b>Detail</b>
Outer face		C
Eyelashes (L)		C
Eye (L)		C
Inner eye (L)		B
Eye (R)		C
Inner eye (R)	Rubbed out and corrected	B
Nose		D
Mouth		C
Teeth	Rubbed out completely twice and corrected without teeth	C
Hair		C
Eyelashes (R)		C
Key: A=Very detailed B=Some detail C=Simple D=Very simple		

#### 4.4.2 Face and eyes

The eyes and outer face were the only features to be given more specific attention by the researcher, as the eyes have been identified as important features in social interaction (Baron-Cohen, 1993).

These are defined in Table 9 and demonstrated by the annotated photograph in Figures 10 and 11 below.

<b>Table 9</b> Explanation of the terms outer eye, inner eye and outer face	
Outer eye	This comprises the eyeball and eyelids
Inner eye	This comprises the iris and the pupils
Outer face	This constitutes a single feature, as shown in Figure 10. This feature could be drawn as a combination of four left quarters of the outer face or two quarters as the right half of the face.



1. Blue quarter – first part drawn
2. Red quarter – second part drawn
3. Yellow quarter– third part drawn
4. Pink quarter – fourth part drawn

**Figure 10** Example of a complex feature: outer face



**Figure 11** Features of the face that were recorded from the students' drawing.

Table 10 below shows which features were grouped into which category.

Each category was given a colour.

<b>Table 10</b> Features grouped by category				
<b>Eye area</b>	<b>Inner face features</b>	<b>Outer face features</b>	<b>Peripheral features</b>	<b>Other specific detail</b>
Eye	Nose	Outer face	Hair	Piercings
Inner eye	Mouth	Chin	Neck	Moles
Glasses	Eyebrows	Beard	Ear	Dimples
	Teeth	Cheeks	Body	Freckles

## 4.5 Difficulties analysing the data

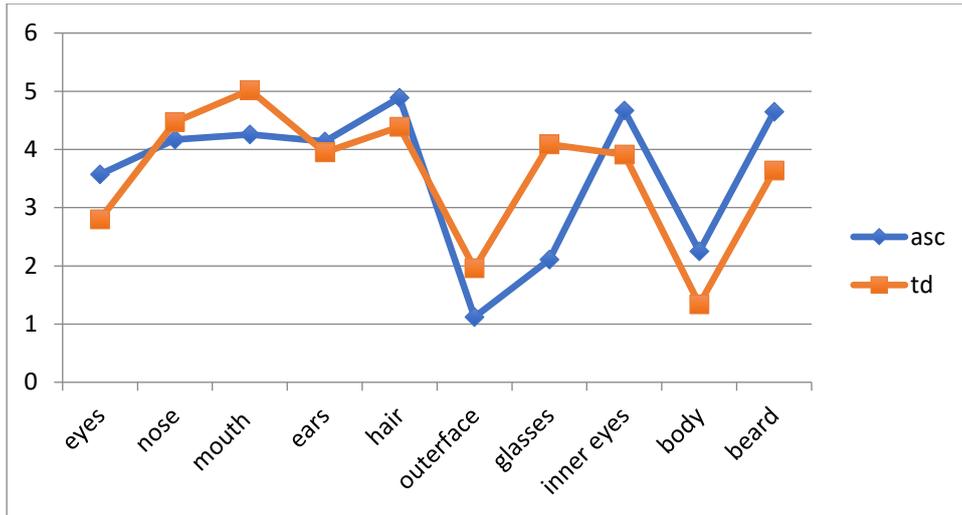
An issue with the initial data gathered was that there were too many differences between the life models the participants were asked to draw (because they all had different life models). This resulted in varying features being present within the students' drawings (for example, one life model had a beard, and one did not).

Furthermore, in the illustrations that required the participant to conjure a face from memory, each participant would naturally imagine a different face. Along with the life-model and self-portrait images, the memory images would often require the participant to draw from a different source from their peers. As these faces all differed, there was no guarantee of the gender of the drawing, or of whether a model wore accessories such as glasses or dental braces. By reducing the data to ten of the features that were consistently drawn, comparisons could be identified between an otherwise overly convoluted data set.

### *4.5.1 Quantified data and descriptive statistic test*

The reduction of the data to ten coded features meant that the data could then be quantified. Descriptive statistics were used to find the mean, median and standard deviation of the selected features. This enabled the data to be given a statistical summary of the order in which the features were drawn. Finding the mean average of each feature drawn showed roughly in which order the two groups drew each feature (for example, drawing the nose second and the mouth fourth.), as illustrated in Tables 11 and 12.

<b>Table 11</b> Results of the mean orders of features drawn										
<b>Autism</b>	<b>Eyes</b>	<b>Nose</b>	<b>Mouth</b>	<b>Ears</b>	<b>Hair</b>	<b>Outer Face</b>	<b>Glasses</b>	<b>Inner Eyes</b>	<b>Body</b>	<b>Beard</b>
Memory	3.14	4.14	4.57	2.50	4.43	1.00	0.00	4.50		
Portrait	3.57	4.29	4	4	4.43	1	2	4.8		5
Cartoon	2.57	3.8	4.14	1	5	1.6	0	3.8	2.25	
Photo	4.71	4.5	4.71	8	5.71	1	4.57	5.4		4.29
Self-port	3.86	4.14	3.86	5.2	4.86	1	4	4.83		
Mean	3.57	4.17	4.26	4.14	4.89	1.12	2.11	4.67	2.25	4.65
<b>TD</b>	<b>Eyes</b>	<b>Nose</b>	<b>Mouth</b>	<b>Ears</b>	<b>Hair</b>	<b>Outer Face</b>	<b>Glasses</b>	<b>Inner Eyes</b>	<b>Body</b>	<b>Beard</b>
Memory	2	4	5	7.5	4.86	2.71	4	3.57		7.5
Portrait	2	4.17	5.14	4	5.29	2.14		3		5
Cartoon	3	4.6	4.86	2	2.33	1.67		3.5	1.67	0
Photo	4.71	4.57	5.67	0	4.71	1.14	4.17	5.67	1	5.71
Self-port	2.29	5	4.43	6.25	4.75	2.14		3.83		0
Mean	2.80	4.47	5.02	3.95	4.39	1.96	4.09	3.91	1.34	3.64
<b>Totals</b>	<b>Eyes</b>	<b>Nose</b>	<b>Mouth</b>	<b>Ears</b>	<b>Hair</b>	<b>Outer Face</b>	<b>Glasses</b>	<b>Inner Eyes</b>	<b>Body</b>	<b>Beard</b>
Autism	3.57	4.17	4.26	4.14	4.89	1.12	2.11	4.67	2.25	4.65
TD	2.8	4.47	5.02	3.95	4.39	1.96	4.09	3.91	1.34	3.64



**Figure 12** Illustrated results of the mean orders of features drawn

These were then put into a linear order demonstrating how often each of these features was drawn and the order in which they were drawn, as illustrated in Table 12.

**Table 12** The mean results of the order in which features were drawn

<b>Autism</b>										
Memory	Outer Face	Ears	Eyes	Nose	Hair	Inner Eyes	Mouth			
Portrait	Outer Face	Glasses	Eyes	Mouth/ Ears	Nose	Hair	Inner Eyes	Beard		
Cartoon	Ears	Outer Face	Body	Eyes	Nose/ Inner Eyes	Mouth	Hair			
Photo	Outer Face	Beard	Nose	Glasses	Mouth/ Eyes	Inner Eyes	Hair			
Self-Portrait	Outer Face	Eyes/ Mouth	Nose	Inner Eyes	Hair	Ears				
<b>TD</b>										
Memory	Eyes	Outer Face	Inner Eyes	Glasses/ Nose	Hair	Mouth	Ears	Beard		
Portrait	Eyes	Outer Face	Inner Eyes	Ears	Nose	Beard	Mouth	Hair		
Cartoon	Outer Face	Body	Ears	Hair	Eyes	Inner Eyes	Nose	Mouth		
Photo	Body	Outer Face	Glasses	Nose	Eyes/ Hair	Inner Eyes	Beard			
Self-Portrait	Outer Face	Eyes	Inner Eyes	Mouth	Hair	Nose	Beard			
Autism	Outer Face	Glasses	Body	Eyes	Ears	Nose	Mouth	Beard	Inner Eyes	Hair
TD	Body	Outer Face	Eyes	Beard	Inner Eyes	Ears	Glasses	Hair	Nose	Mouth
<b>Removing body and beard</b>										
Autism	Outer Face	Glasses	Eyes	Ears	Nose	Mouth	Inner Eyes	Hair		
TD	Outer Face	Eyes	Inner Eyes	Ears	Glasses	Hair	Nose	Mouth		
<b>Only features with high presence in drawings</b>										
Autism	Outer Face	Nose	Mouth	Inner Eyes	Hair					
TD	Outer Face	Inner Eyes	Hair	Nose	Mouth					
<b>Removing only the body</b>										
Autism	Outer Face	Glasses	Eyes	Ears	Nose	Mouth	Beard	Inner Eyes	Hair	
TD	Outer Face	Eyes	Beard	Inner Eyes	Ears	Glasses	Hair	Nose	Mouth	

## 4.6 Findings

Some of the features were drawn less often than others. These features were removed in some comparisons to allow for the more consistently drawn features to be compared. Features that were less consistently drawn by both groups included the ears, which were drawn 31% of the time; the body (11% of the time); glasses (26% of the time); and beards (also drawn 26% of the time). Glasses and beards were expected to vary in their frequency of inclusion, as each student was asked to draw different life models and different individuals from memory. However, it was not expected that the research would uncover such an infrequent depiction of ears in the study, as Meaux et al.'s study (2014) had reported a larger frequency of ears being drawn by autism groups.

The results of this study show that there may be a difference in how early the eyes are drawn by TD students, as the eyes are sometimes drawn slightly sooner than by those with autism, with a slightly larger tendency to draw the eyes and inner eyes around the same time. This is in contrast to the autism group, who draw the outer eyes and then move on to other features. Due to the small sample size, these comparisons cannot be tested for significance.

#### 4.6.1 Further analysis

**Table 13** The frequency of features drawn

Autism Participant (P)	Eyes	Nose	Mouth	Ears	Hair	Outer Face	Glasses	Inner Eyes	Body	Beard
P1	5	4	4	1	4	5	2	4	1	1
P2	5	4	5	1	4	5	1	3		1
P3	5	4	5	1	4	5	2	5		2
P4	5	5	5	4	4	4	1	4	1	2
P5	5	5	5		4	4	1	5	1	1
P6	5	5	5	3	4	5	1	2	1	1
P7	5	5	5	1	5	5	1	4		1
35	35	32	34	11	29	33	9	27	4	9
	100%	91%	97%	31%	83%	94%	26%	77%	11%	26%
TD	Eyes	Nose	Mouth	Ears	Hair	Outer Face	Glasses	Inner Eyes	Body	Beard
P1	5	5	5	2	5	5	1	4		1
P2	5	4	5	0	4	4	1	5	2	1
P3	5	5	5	2	4	5	1	4		1
P4	5	4	5		4	5	2	5	1	2
P5	5	5	5	2	5	5	1	5		1
P6	5	5	4	3	5	5	1	3		2
P7	5	4	5	2	4	5	1	4	1	2
35	35	32	34	11	31	34	8	30	4	10
	100%	91%	97%	31%	89%	97%	23%	86%	11%	29%

In order for the results of the data to be studied for any potential relationships between participants with autism and the TD group, the ten features were then further reduced to four categories of features, to enable the data to be interpreted using a deduction method of statistical analysis. This enabled the results to be studied for any potential relationships between participants by using a chi-squared test and t-tests to find statistical evidence (Thomas, 2013).

In this reduction of the data, the features were allocated to four sections of the face.

These were:

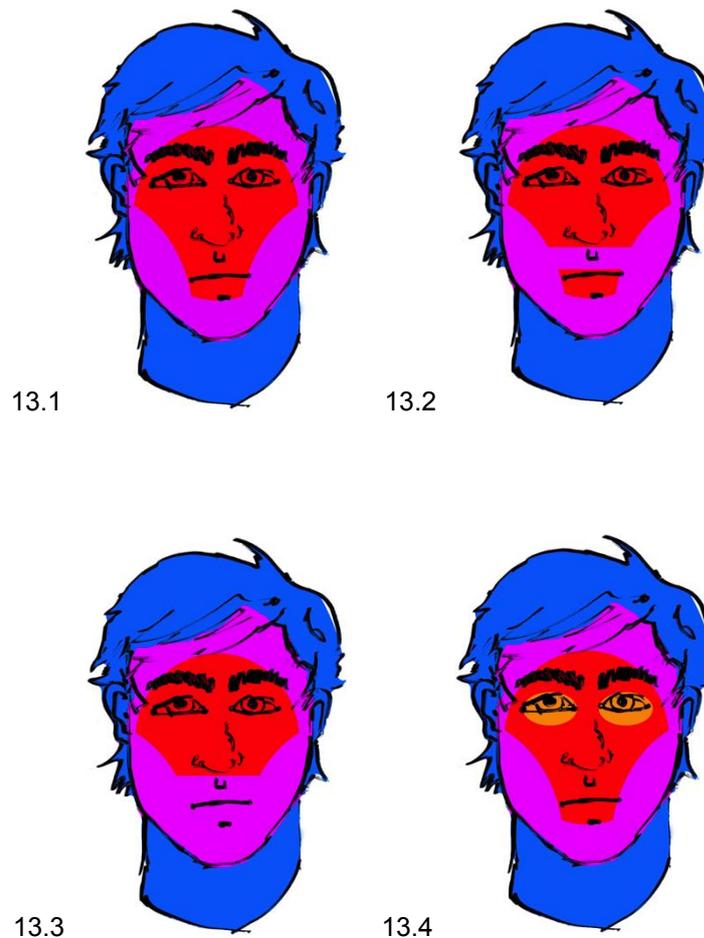
*Orange sections:* eyes and inner eyes

*Red sections:* inner face; nose and mouth

*Purple sections:* outer face; shape of face, beards and any varying details such as dimples or freckles

*Blue sections:* head area; ears, hair, neck and the body

There were several attempts to define the sections of the face before the final grouping of features was achieved, as shown in Figures 13.1 to 13.4 below.



**Figure 13** Stages of coding

By identifying which features should belong to which areas of the face, the data could be coded and analysed to find out if there was a repeated order in which features were drawn. Figure 13.1 was the first of the series. It has sectioned the face into three groups of features, combining the inner features of the face (red) and separating them from the outer areas (purple and blue). Three areas of the face were identified so that the data could show the order in which the face was drawn.

Using these three coloured sections, the researcher began identifying which features should be grouped into which coloured area of the face. The four figures (13.1–13.4) illustrate the decision-making process of how to group the different features by colour. Figure 13.2 shows the mouth being broken down into multiple features by separating the mouth from the philtrum. In Figure 13.3 the mouth is separated from the inner face completely and redefined as part of the outer area of the face, which includes the outline of the outer face and cheeks etc.

After this exploration, the final figure, 13.4, was identified as the best method of grouping the features. Figure 13.4 includes a fourth area of interest, which enabled the eyes to become a standalone feature. Klins' study (2002) of eye gaze identifies a difference in how the eyes are observed in face processing. It is for this reason that the researcher chose to add eyes to the colour-coded groupings of facial features.

The mean averages of the data were again compared and arranged to produce an order in which areas were drawn. This compared the orders of both groups when drawing each individual task and then compiled the averages of all the tasks to produce an overall order. Comparing the order of the individual tasks enabled data to

be compared from another angle to see if any task produced strikingly different results.

<b>Table 14</b> Order of drawn features of a face				
<b>AS</b>	<b>Orange</b>	<b>Red</b>	<b>Purple</b>	<b>Blue</b>
Memory	2.86	3.00	1.00	3.14
Portrait	3.00	3.00	1.00	3.00
Cartoon	2.86	3.29	1.67	1.00
Photo	3.00	2.71	1.00	3.29
Self	3.14	2.57	1.00	3.29
Average	2.97	2.91	1.13	2.74
Median	3.00	3.00	1.00	3.14
Stand dev	0.12	0.28	0.30	0.98
<b>TD</b>	<b>Orange</b>	<b>Red</b>	<b>Purple</b>	<b>Blue</b>
Memory	1.71	3.14	1.86	3.57
Portrait	1.86	3.00	1.57	3.57
Cartoon	2.86	3.57	1.50	1.71
Photo	3.00	3.43	1.14	2.43
Self	2.14	3.00	1.57	3.29
Average	2.31	3.23	1.53	2.91
Median	2.14	3.14	1.57	3.29
Stand dev	0.58	0.26	0.26	0.82

<b>Table 15</b> Order of drawn features coded by colour				
<b>AUTISM</b>				
Memory	Purple	Orange	Red	Blue
Portrait	Purple	O/r/b	O/r/b	O/r/b
Cartoon	Blue	Purple	Orange	Red
Photo	Purple	Red	Orange	Blue
Self	Purple	Red	Orange	Blue
<b>TD</b>				
Memory	Orange	Purple	Red	Blue
Portrait	Purple	Orange	Red	Blue
Cartoon	Purple	Blue	Orange	Red
Photo	Purple	Blue	Orange	Red
Self	Purple	Orange	Red	Blue

Key:

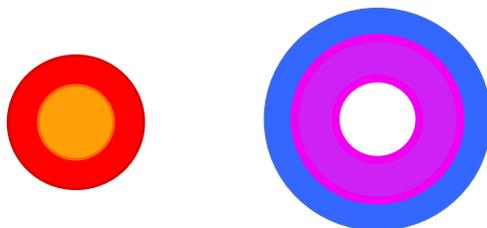
*Orange sections:* eyes and inner eyes

*Red sections:* inner face; nose and mouth

*Purple sections:* outer face; shape of face, beards and any varying details such as dimples or freckles

*Blue sections:* head area; ears, hair, neck and the body

Further grouping the data into sections meant that more complex questions could be asked of the data. This enabled deduction statistical tests to be carried out to find possible inferences between the two groups. The data was arranged so that yes/no questions could be asked of the data. Four sections were paired off to reduce the data, in order to be able to answer a simple yes or no question using a chi-square test, which showed the significance of the data, as illustrated in Figure 14.



**Figure 14** Inner/local feature

Outer/global feature

These two groups were constructed with the intention of showing local and global processing of a face, with local features being understood as the central features, such as the eyes, nose and mouth (defined previously in Figure 13), and global features being understood as the features (defined previously in Figure 13) positioned at the periphery of the face, i.e. cheeks or chin, including the shape of the face itself.

The question asked of the data was, “Did the participants start with the inner features first?” This question required an answer that enabled the researcher to clearly identify if the participants began with the peripheral features of the face or the central face, and identify if they started drawing the inner face or the outer face first. This question was chosen after analysing questions asked by other studies, such as “How do individuals with autism mentally represent a face?” (Meaux et al., 2014), and “Is there a local or global bias in how people on the autism spectrum draw?” To complement the existing data around autism and face processing and to answer this question, orange and red groupings were paired, compiling the eyes and the inner facial features and separating them from the outer face and peripheral features. This meant that the data could be examined to see if participants started with the inner face.

The data was entered into SPSS, and the software was used to ask if participants started with either the orange areas or the red areas. The researcher then used both a chi-square test and a t-test to simultaneously show the likelihood of this and of the data being obtained by chance.

Table 16 SPSS results			
Inner face first	Autism	TD	Total
0	7	4	11
1	0	3	3
Total	7	7	14
Pearson chi2(1) = 3.8182 Pr = 0.051			

#### 4.6.2 Definitions of the level of detail

A coding system was used to ascertain how detailed each of the features was. Each drawing was catalogued according to the level of detail, as follows:

A = Very detailed

*High level of detail, with extra attention given to depicting complex features. Lots of focus on the personal characteristics of the person they are representing – for example, drawing the wrinkles in the skin around the eye and eyebrow or the details of the ears, including the intricate cartilage folds of the inner ear.*

B = Some detail

*Detail added to an area after drawing the general shape. Here time and effort has been spent on trying to attain a likeness of the model, for example when complex features have been drawn with some attention to detail.*

C = Simple

*Simple depiction of the area drawn. Characteristics of the model have been added, but little attention has been paid to them. Some focus has been given to particular*

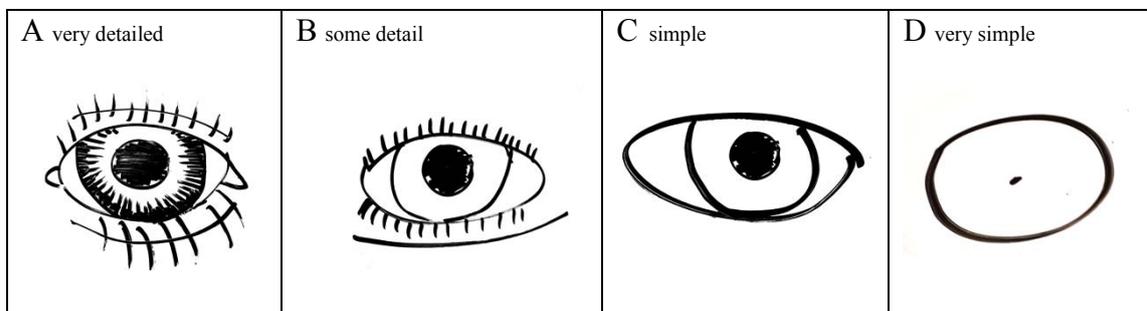
specific features of the model, but this is minimal, only enough to elevate the image from the symbol that typically represents the features.

D = Very simple

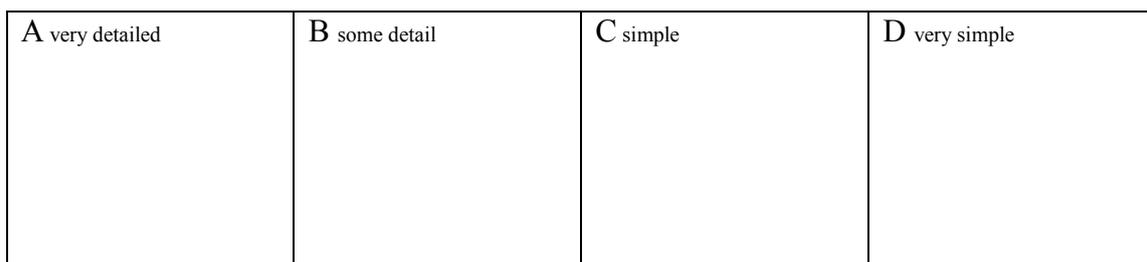
Very simple outline of the shape of the area and very little time spent. No likeness to the individuals drawn, beyond sex and hair length. The reduction of the face to semiotic symbols (e.g., cartoons without tonality<sup>1</sup>, a stick man, or a simple circle with a dot in the middle to represent an eye).

#### 4.6.3 Illustrated definition of detail

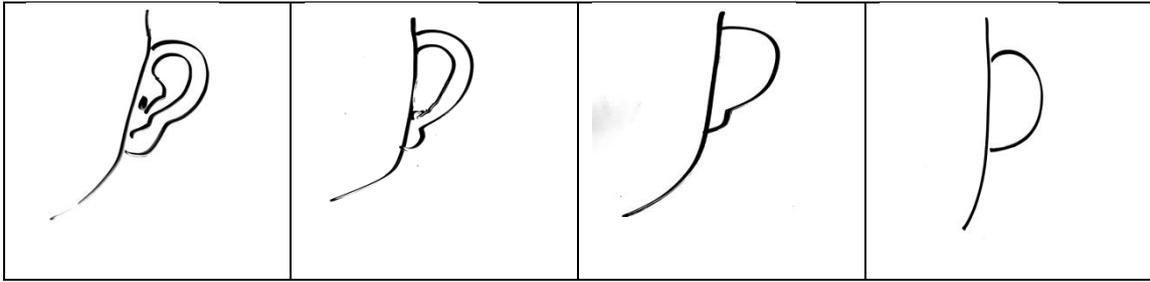
The different levels of detail for five different features are illustrated below.



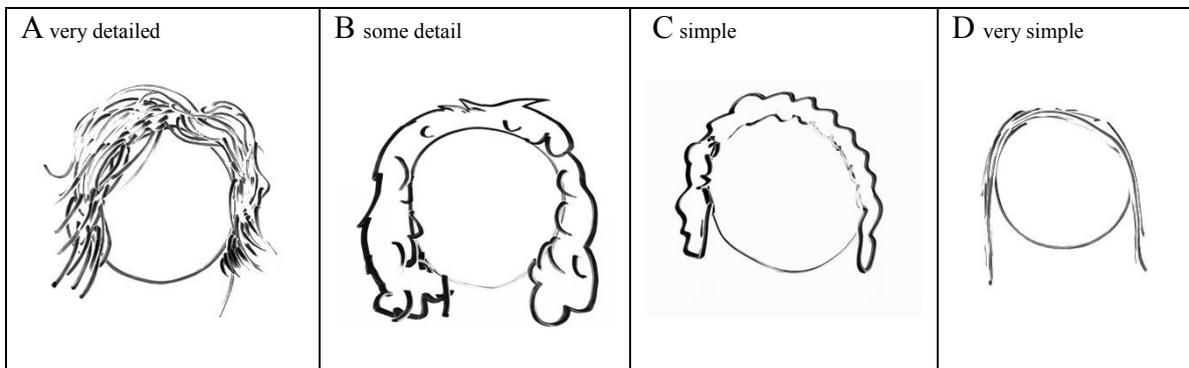
**Figure 15** Example of gradations of detail drawn for eyes



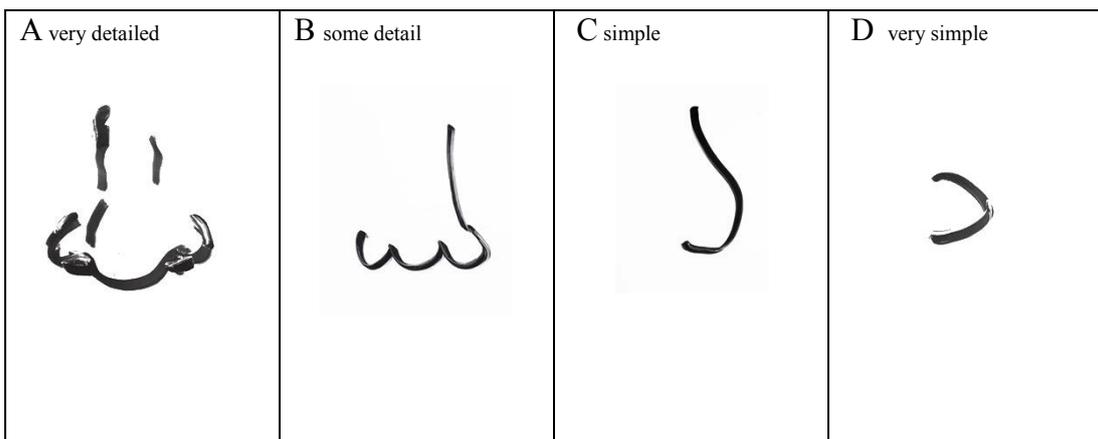
<sup>1</sup> Tonal drawing: The lightness or darkness of something – this could be a shade, or how dark or light a colour appears (<http://www.tate.org.uk/learn/online-resources/glossary/t/tonal>).



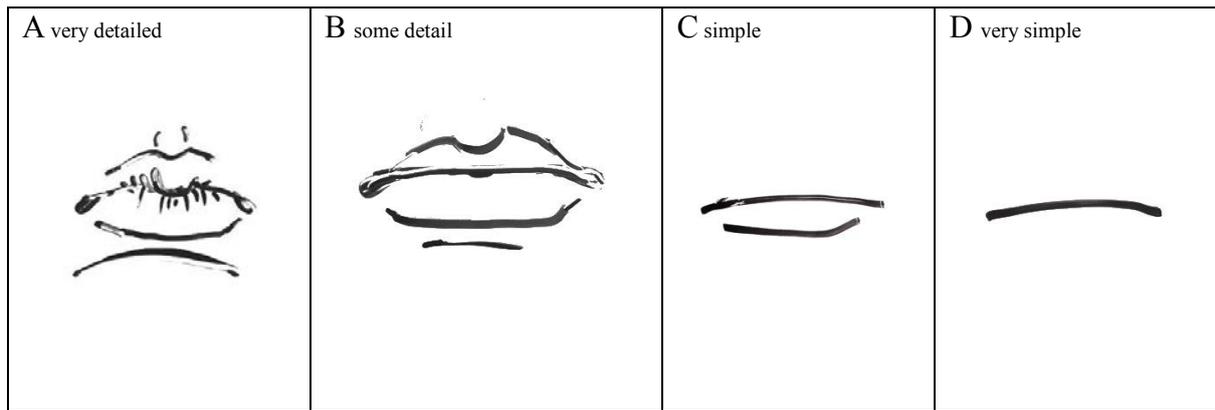
**Figure 16** Example of gradations of detail drawn for ears



**Figure 17** Example of gradations of detail drawn for hair



**Figure 18** Example of gradations of detail drawn for noses



**Figure 19** Example of gradations of detail drawn for mouths

The level of detail drawn was recorded using the gradation system A, B, C and D, as depicted above.

Table 17 illustrates how data was recorded for each of the five tasks. The green highlights how detail was recorded in the researcher's notes.

Order	Corrections	Detail
Outer face		C
Eyelashes (L)		C
Eye (L)		C
Inner eye (L)		B
Eye (R)		C
Inner eye (R)	Rubbed out and corrected	B
Nose		D
Mouth		C
Teeth	Rubbed out completely <b>twice</b> and corrected without teeth	C
Hair		C
Eyelashes (R)		C

Key:  
 A=Very detailed  
 B=Some detail  
 C=Simple  
 D=Very simple

Table 18 contains short notes of the corrections that participants made, which are highlighted in green. A correction was recorded when the participant used a rubber to make a correction or when they restarted the entire drawing. The extent of the correction was also recorded – that is, whether it was a small correction to the corner of the mouth or a small line of the eye, or if the whole area of the nose was rubbed out.

<b>Table 18</b> Example of how corrections were recorded		
<b>Order</b>	<b>Corrections</b>	<b>Detail</b>
Outer face		C
Eyelashes (L)		C
Eye (L)		C
Inner eye (L)		B
Eye (R)		C
Inner eye (R)	Rubbed out and corrected	B
Nose		D
Mouth		C
Teeth	Rubbed out completely twice and corrected without teeth	C
Hair		C
Eyelashes (R)		C

Key:  
 A=Very detailed  
 B=Some detail  
 C=Simple  
 D=Very simple

The level of detail was determined by how intricately each feature was drawn. For example, when drawing the eye, it was necessary to examine if participants shaded<sup>2</sup> the iris or added eyelashes. The way participants drew independent features was

<sup>2</sup> Darken or colour (an illustration or diagram) with parallel pencil lines or a block of colour (<http://www.oxforddictionaries.com>).

also recorded (e.g. if they drew the shape first and added detail later). For example, a depiction of the mouth as a synthesis of marks depicting the interior and external shapes would be classified as “Very detailed” (A). Drawing the mouth and then adding detail would be recorded as “Some detail” (B). If a participant had not added much detail, only drawing the shape of the mouth, then it would be recorded as “Simple” (C); and a basic representation of a particular part of the face would be classified as “Very simple” (D).

#### 4.6.4 Touch-ups and revisions after the main features had been drawn

In this study, the revision of features is defined as drawing a feature, continuing with the rest of the face, then revisiting and changing the original feature that was drawn first. Any modification of the drawing in this manner was recorded separately. As an example, Table 19 highlights in green the levels of detail recorded for hair and for any detail that was subsequently added to hair as described above.

<b>Table 19</b> How the researcher documented changing levels of detail of features		
<b>Order</b>	<b>Corrections made, if any</b>	<b>Detail</b>
Hair		C
Outer face		C
Eyes		D
Nose		D
Mouth		C
Ears		C
Added hair detail		B

Key:

A=Very detailed

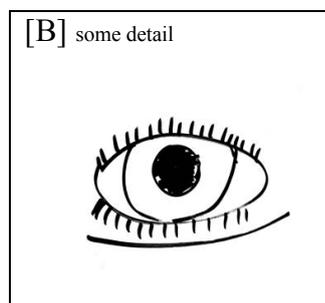
B=Some detail

C=Simple

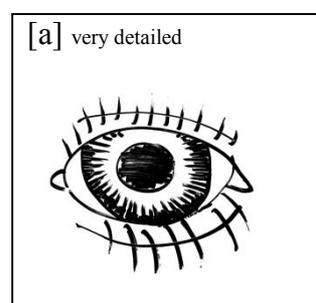
D=Very simple

It was important to include the amount of detail that the touch-up added to the feature. This could be the act of going over the pre-existing shape of the feature, or adding new details.

An example amendment is illustrated in Figures 20 and 21, with Figure 20 as the initial completed eye, and Figure 21 as the same eye following later revision with increased detail. Any time a drawing was amended, it had a code allocated, but in lower case letters (i.e., a, b, c, d) to differentiate it from the initial drawing grade and to demonstrate that a change had been made. This modification could be positive (i.e., more detail had been added) or negative (i.e., detail had been removed), as illustrated below.



**Figure 20**



**Figure 21**

The coding of the detail of the features followed the same reduction path as the cataloguing of the order of features. The ten features previously identified were entered into a tally chart to show how often each feature was drawn and to what standard of detail. Table 20 gives an example of how this was documented. This enabled the researcher to identify which areas, if any, the two groups differed in, with

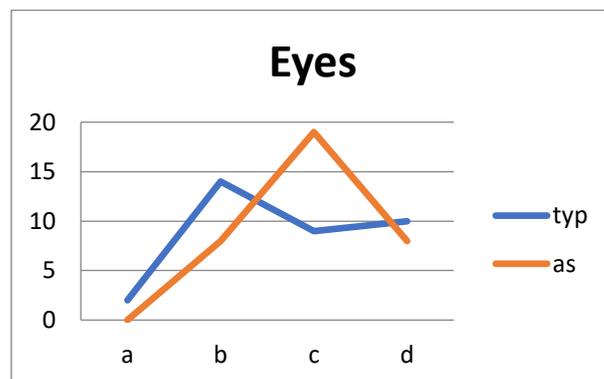
regard to the amount of detail given. The researcher was then able to compare the two groups by creating graphs (see Figures 22 to 30 below).

**Table 20** Tally chart used to record the level of detail given for ten features

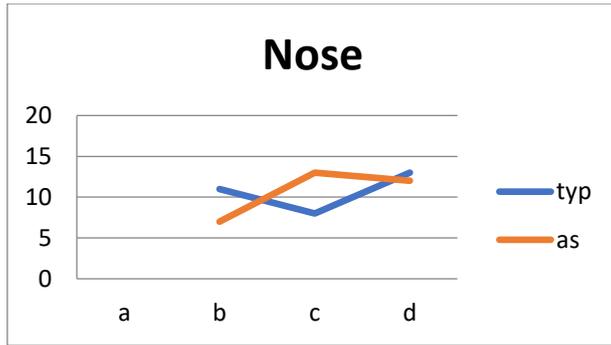
AUTISM	Eyes	Nose	Mouth	Ears	Hair	Outer Face	Glasses	Inner Eyes	Body	Beard
Participant 1										
A										
B	1	2	2		1		1	1		
C	3	1	1		1	3	1	1		1
D	1	1	1	1	2	1			1	

#### 4.6.5 Results highlighting a difference seen in the level of detail given to each feature

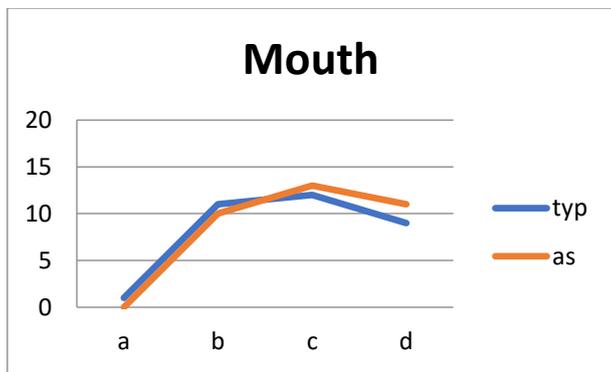
The graphs drawn identified how the groups differed with regard to key features, with the most noticeable difference being in relation to the eyes. The graphs demonstrate the differences between the participants with autism and TD participants in relation to the level of detail they gave to each feature, as illustrated below.



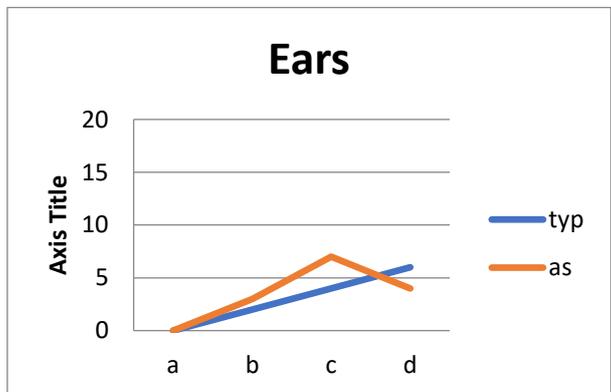
**Figure 22** Comparing the level of detail the students gave to eyes



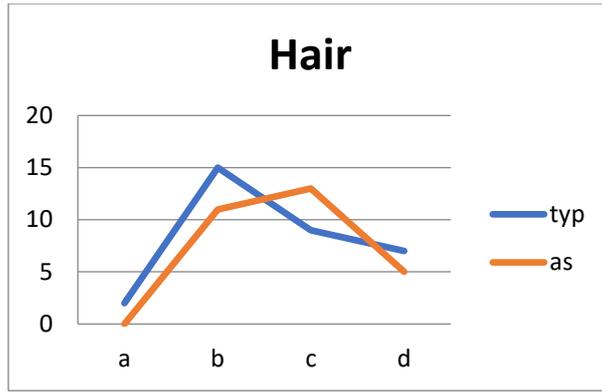
**Figure 23** Comparing the level of detail the students gave to the nose



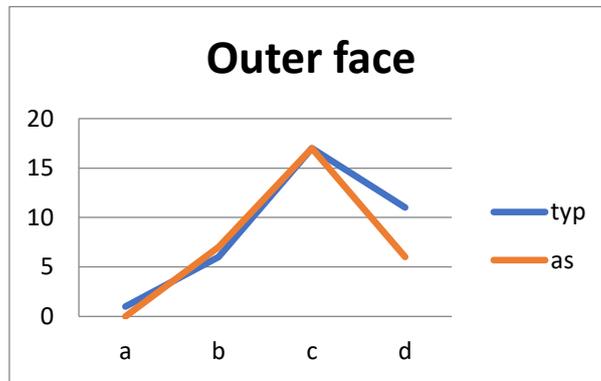
**Figure 24** Comparing the level of detail the students gave to the mouth



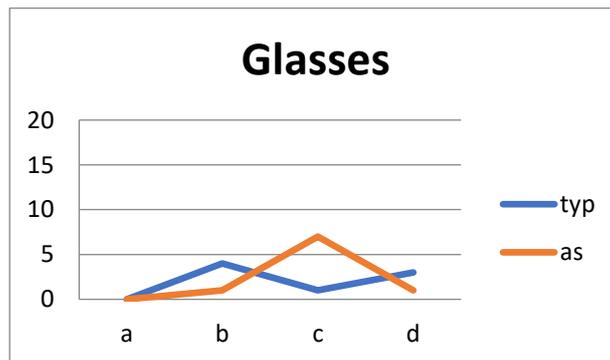
**Figure 25** Comparing the level of detail the students gave to ears



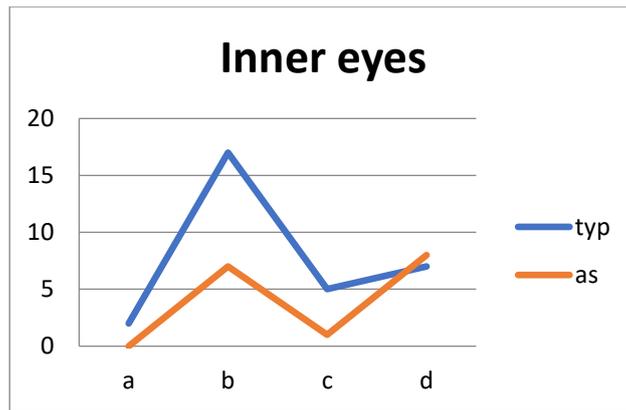
**Figure 26** Comparing the level of detail the students gave to hair



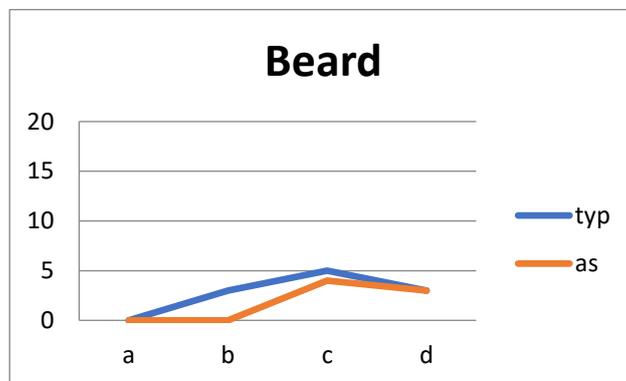
**Figure 27** Comparing the level of detail the students gave to the outer face



**Figure 28** Comparing the level of detail the students gave to glasses



**Figure 29** Comparing the level of detail the students gave to the inner eyes



**Figure 30** Comparing the level of detail the students gave to beards

These features were then also reduced to the four areas previously explained (eyes, inner face, outer face, peripheral features) in order to calculate percentages for which features were given a high amount of detail.

This enabled percentages of the areas that were commonly drawn to show the degree of detail, enabling the researcher to compare each area and identify areas that were consistently drawn with a high amount of detail.

The results are presented in Tables 21 and 22 below.

<b>Table 21</b> Level of detail given to each area of the face by both autism and TD participants					
TD			AUTISM		
A	9	4%	A	0	0%
B	86	36%	B	56	25%
C	72	30%	C	110	48%
D	70	30%	D	61	27%
Total	237		Total	227	

<b>Table 22</b> Level of detail given to each area of the face by both autism and TD participants									
TD	Orange		Red		Purple		Blue		Total
A	5	6%	1	1%	0	0%	2	4%	8
B	39	50%	24	36%	8	19%	15	31%	86
C	16	21%	19	28%	24	56%	13	27%	72
D	18	23%	23	34%	11	26%	18	38%	70
Total	78		67		43		48		236
Autism	Orange		Red		Purple		Blue		
A	0	0%	0	0%	0	0%	0	0%	0
B	18	25%	15	22%	8	20%	15	34%	56
C	37	51%	29	42%	24	59%	20	45%	110
D	18	25%	25	36%	9	22%	9	20%	61
Total	73		69		41		44		

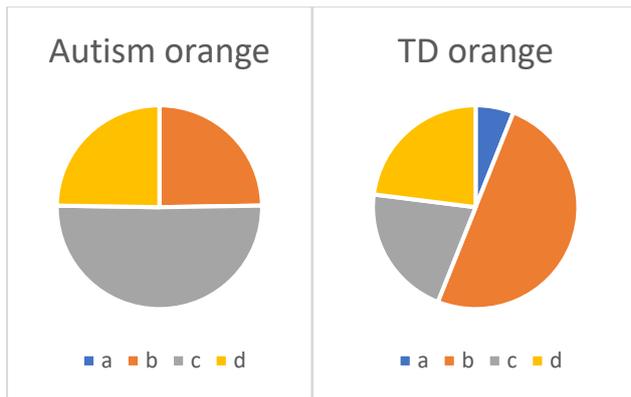
Key:

*Orange sections:* eyes and inner eyes

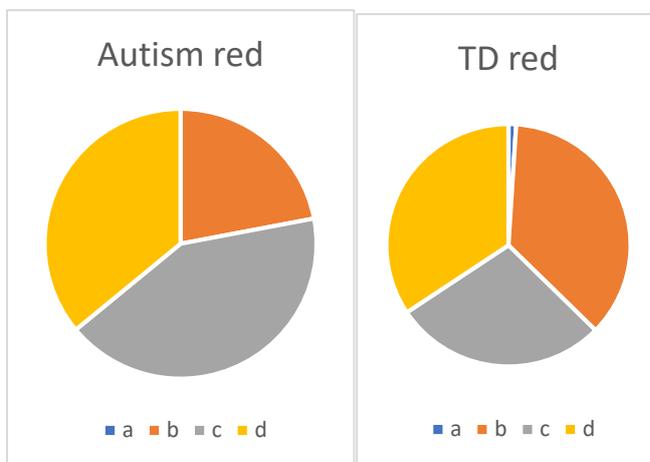
*Red sections:* inner face; nose and mouth

*Purple sections:* outer face; shape of face, beards and any varying details such as dimples or freckles

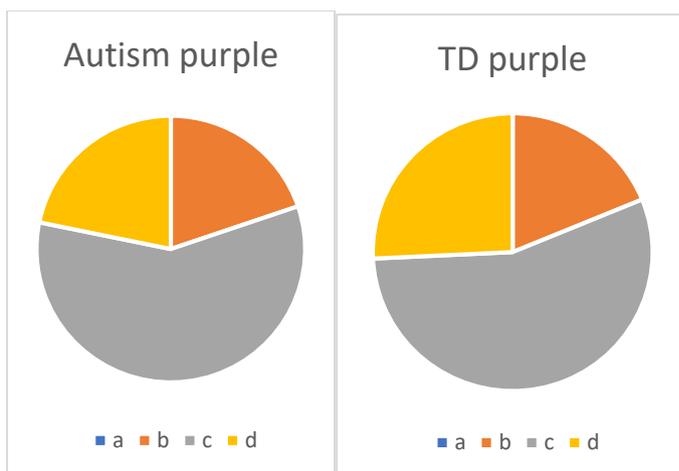
*Blue sections:* head area; ears, hair, neck and the body



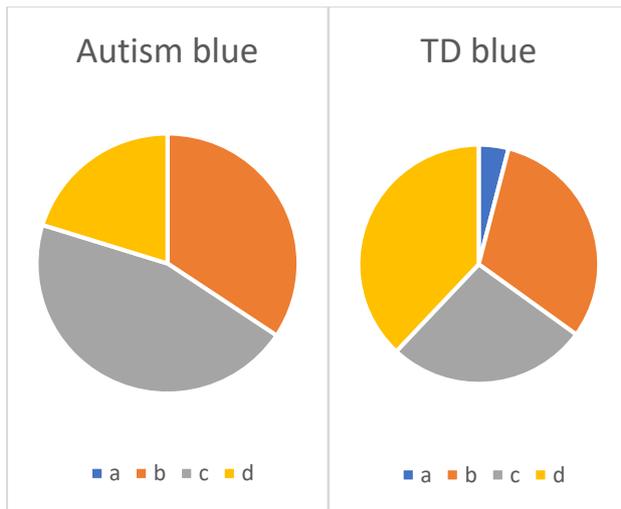
**Figure 31** Pie charts 1 and 2 show the level of detail given to the orange areas of the face by both autism and TD participants



**Figure 32** Pie charts 3 and 4 show the level of detail given to the red areas of the face by both autism and TD participants.



**Figure 33** Pie charts 5 and 6 show the level of detail given to the purple areas of the face by both autism and TD participants



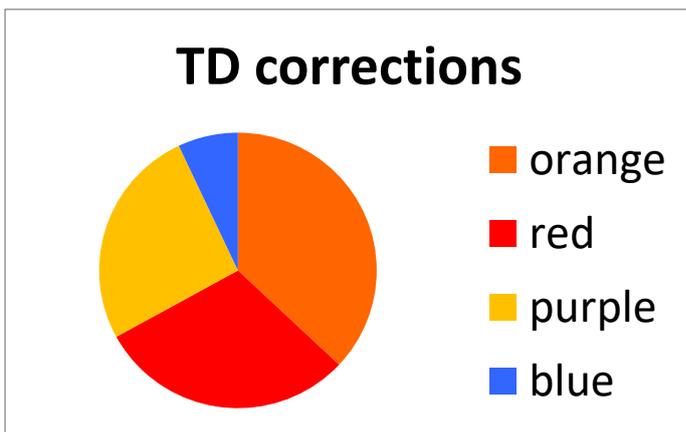
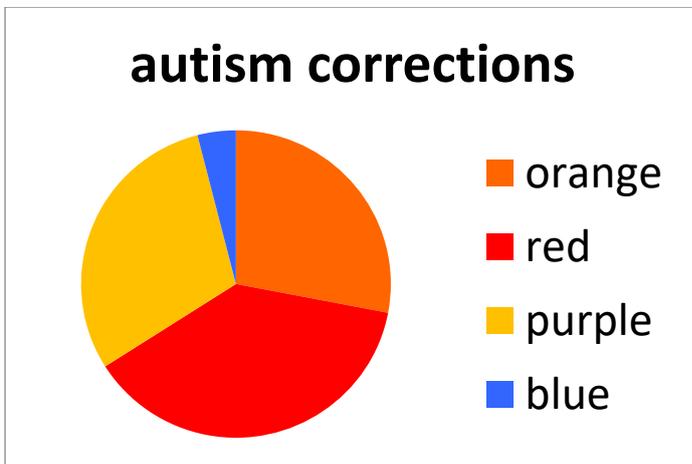
**Figure 34** Pie charts 7 and 8 show the level of detail given to the blue areas of the face by both autism and TD participants

**Table 23** Results of the corrections made by participants to their drawings

Task	Autism	Autism	Typical	Typical
1	Eyes	1	Eyes	4
1	Inner eyes	2	Inner eyes	0
1	Glasses	0	Glasses	1
1	Nose	1	Nose	0
1	Mouth	2	Mouth	2
1	Chin	0	Chin	0
1	Ears	0	Ears	0
1	Beard	0	Beard	0
1	Hair	0	Hair	0
1	Outer face	2	Outer face	1
Total		8		8
Task	Autism	Autism	Typical	Typical
2	Eyes	0	Eyes	1
2	Inner eyes	2	Inner eyes	2
2	Glasses	1	Glasses	0
2	Nose	3	Nose	2
2	Mouth	1	Mouth	0
2	Chin	0	Chin	0
2	Ears	0	Ears	0
2	Beard	0	Beard	0
2	Hair	0	Hair	0
2	Outer face	6	Outer face	1
Total		13		6
Task	Autism	Autism	Typical	Typical
3	Eyes	2	Eyes	1
3	Inner eyes	0	Inner eyes	0
3	Glasses	0	Glasses	0
3	Nose	0	Nose	0
3	Mouth	3	Mouth	1
3	Chin	0	Chin	0
3	Ears	1	Ears	0
3	Beard	0	Beard	0
3	Hair	0	Hair	0
3	Outer face	0	Outer face	2
Total		6		4
Task	Autism	Autism	Typical	Typical
4	Eyes	0	Eyes	0
4	Inner eyes	2	Inner eyes	0
4	Glasses	1	Glasses	0
4	Nose	2	Nose	0
4	Mouth	2	Mouth	0
4	Chin	1	Chin	0
4	Ears	0	Ears	0
4	Beard	0	Beard	0
4	Hair	0	Hair	0
4	Outer face	2	Outer face	0
Total		10		0
Task	Autism	Autism	Typical	Typical
5	Eyes	1	Eyes	1
5	Inner eyes	2	Inner eyes	0
5	Glasses	0	Glasses	0
5	Nose	2	Nose	1
5	Mouth	3	Mouth	2
5	Chin	3	Chin	0
5	Ears	1	Ears	0
5	Beard	0	Beard	0
5	Hair	0	Hair	2
5	Outer face	1	Outer face	3
Total		13		9
Total overall		50		27

**Table 24** The percentages of corrections made to each area of the face

Area		AUTISM		TD
Orange	14	28%	10	37%
Red	19	38%	8	30%
Purple	15	30%	7	26%
Blue	2	4%	2	7%



**Figure 35** Pie charts 9 and 10 illustrate the percentages of corrections made to each area of the face visually

Key:

*Orange sections:* eyes and inner eyes

*Red sections:* inner face; nose and mouth

*Purple sections:* outer face; shape of face, beards and any varying details such as dimples or freckles

*Blue sections:* head area; ears, hair, neck and the body

#### *4.6.6 Participants' use of reference points when drawing*

This area of the study relied on the researcher's interpretation. The researcher's understanding of the students' use of reference points was built on the students' ability to be attentively observant and to be conscious of recognising what had been observed and not inferred. With this in mind, the researcher was limited in the amount of data that could be documented, as he only had five minutes to make the recordings, focusing on a wide variety of areas, such as recording the order the features were drawn, studying the level of detail with which features were drawn, moving the camera to document this in detail, etc.

The frequency with which a participant looked at a source allowed the researcher to make an assumption about how important the sources were to the drawn images. Due to the fact that this could be nothing more than an assumption by the researcher, the data could be naturally inconsistent and biased. The researcher therefore decided not to go into too much detail about this, as it would rely on the researcher's handwritten notes alone, and no further evidence. The researcher observed how often the students would look up from their drawings to observe the source, and at the end of each of the tasks the researcher would then make a note of how often this was. The researcher did not only take into account how often this occurred, but also how intensely the participant studied their model. The researcher noted where the participant looked and what they were observing. For example, the researcher examined whether the participant was observing the subtleties of a feature, or rather gaining a more simple understanding of what the model looked like,

such as the length of their hair. The researcher then identified whether these observations were just glances or long, considered stares, factoring in whether the participant took proper time to identify characteristics of the feature they were drawing. The researcher could also identify if the participant did not use the source at all, choosing instead to rely solely on their own mental concept of the face.

This information was not recorded as part of the video recordings, as it would have been unethical to record the participants' faces during the research study. Only their drawn images were recorded, to comply with confidentiality and anonymity regulations.

The data were coded into five categories to allow for a more comparable set to be analysed when examining the findings. As it was not possible to reliably record how many times participants used the reference points, a description from the researcher's handwritten notes was used, as follows:

#### *4.6.7 Use of sources*

**1. Very low**

*Not drawing from models or sources.*

**2. Low**

*Minimal use of the models or sources.*

**3. Moderate**

*Sometimes using sources to guide illustration.*

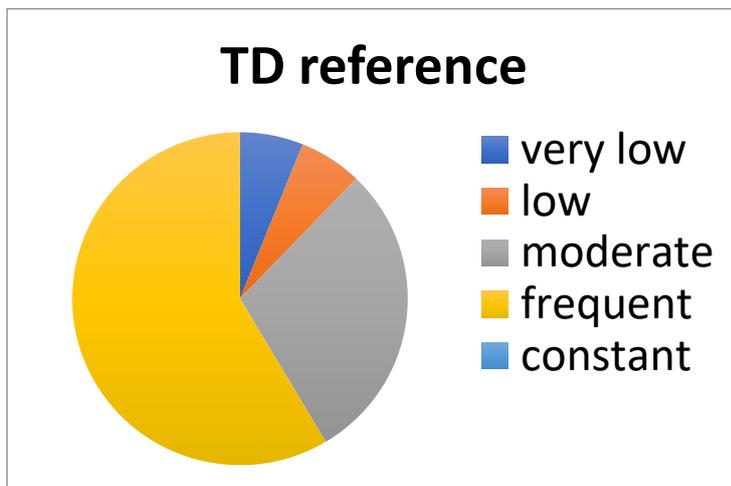
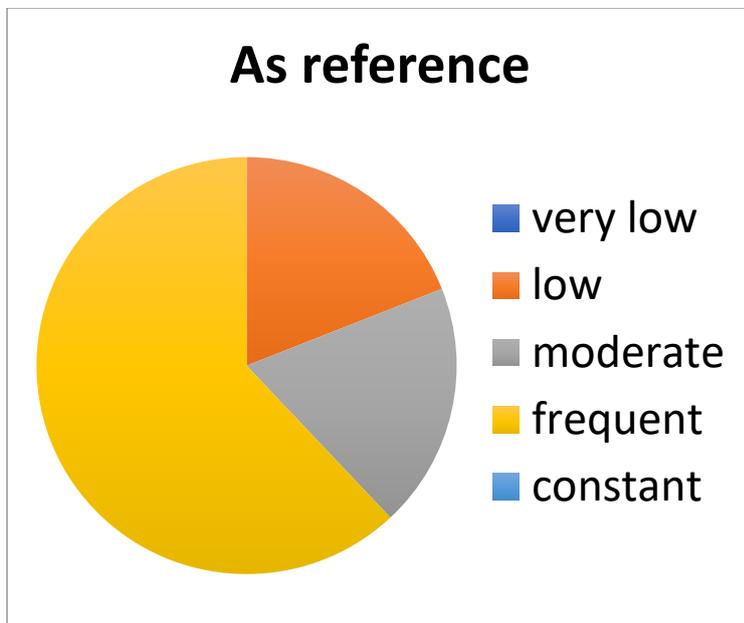
**4. Frequent**

*Frequently using sources to draw from. Altering images accordingly. Paid attention to accuracy.*

**5. Constant**

*Using reference points constantly.*

Table 25 Use of reference source				
TD	1.	Very low	1	5%
TD	2.	Low	1	5%
TD	3.	Moderate	5	24%
TD	4.	Frequent	10	48%
TD	5.	Constant	4	19%
	Total		21	
Autism	1.	Very low	0	0%
Autism	2.	Low	4	19%
Autism	3.	Moderate	4	19%
Autism	4.	Frequent	13	62%
Autism	5.	Constant	0	0%
	Total		21	



**Figure 36** Pie charts 13 and 14. Results of participants' use of the reference points during the tasks

#### 4.6.8 Amount of interest the participants appeared to show in the task

It was important to catalogue the amount of interest participants showed in the task. This section was coded into three categories. Choosing these three categories provided a very superficial idea of how participants felt, relying on the researcher's subjectivity and ability to extrapolate how the participants acted during the process, with an acknowledgement that this has limitations and would not generate robust data for analysis.

An opinion was drawn from how they acted before and after the tasks, how they spoke with the researcher, how calm they seemed, and how many mistakes they wanted to correct (if a participant wanted to correct a mistake, this suggested that they cared about their illustration). The researcher also looked at how much detail they gave to their pictures overall. Was their picture rushed, with very little detail, or did they take the full five minutes and edit their picture thoroughly? As this was relying on the researcher to extract this meaning at the same time as collecting the main data, it was important that this task be as simple as possible, so that it could fit in well with the other observations. There were three categories, as follows.

*Low interest* - Very little time spent on image – image very simple.

*Engaged* - Correcting mistakes or making minor corrections.

*High interest* - Completely focused on activity. Trying very hard to obtain likeness of image.

Recording the amount of interest that the participants showed in the task relied on the researcher's ability to observe students' behaviour. An example of this would be observing the quality of the image that was being drawn, with the assumption that a very simple image, where students resorted to very simple semiotic depictions of a face, involved the least amount of effort. This was coupled with the speed with which the student drew, as very little energy being spent on a quick image implied a lack of effort or interest in a task. The ability to cross-compare with the other images that the students created built up a picture of each participant's interest in the five tasks. The researcher also observed the interactions of the student with the researcher themselves and the teaching staff present. For example, if a student presented a calm, happy demeanour, asking questions and interacting with the staff, this suggested to the researcher that the student was interested in the task, as opposed to a student being unengaged and withdrawn from the task. How the student responded to encouragement also presented opportunities to gauge how the students were feeling about the research, as a negative response to a positive comment indicated that the student could be feeling stressed or lack confidence. Two examples of comments they made were:

*Student – "I'm rubbish at drawing, I can't even draw a stick man."*

And

*Student – "Do I have to draw my teacher, can't I draw anyone else? What if I do it wrong?"*

These examples give a clear indication of a student's feelings about their abilities. All data gathered in this manner was susceptible to biases, and consequently the

researcher's acknowledgement of the influence of assumptions, opinions and biases in this area was crucial to the documentation of the data. The importance of the researcher's engagement in the tasks was what kept the observations as clear and true as possible, reporting what was noticed without assumptions, as recommended by Thomas (2013).

Both the interest of the students in the task and how often they looked at what they were drawing were entered into a tally chart. The data collected during the drawing of the pictures was coded into number form, to enable this to be quantified. The codes were:

Participants' use of source:

1 = low

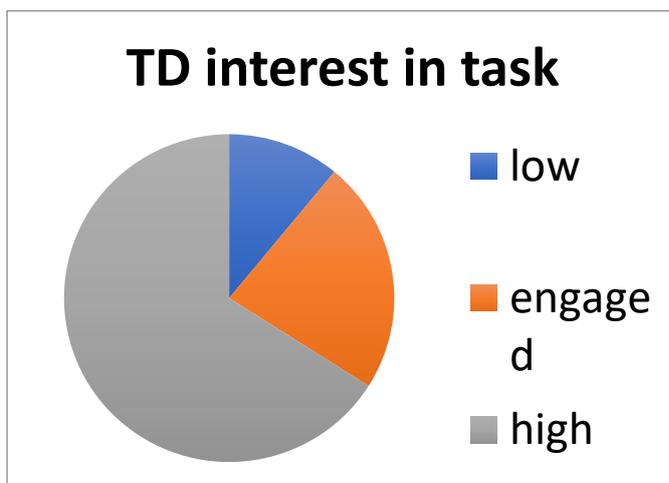
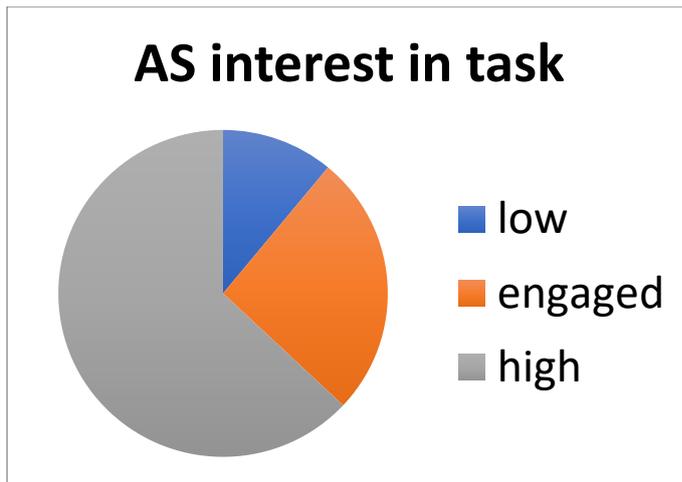
2 = engaged

3 = high

This was then used to calculate the percentages of the frequencies of these behaviours, allowing comparisons to be made between the students' behaviours when carrying out the tasks.

**Table 26** Results of participants' interest in tasks and their behaviours in relation to the use of reference points during the tasks.

Participants	Level of Interest	No of images drawn	% ratio
TD	<b>1=Low</b>	4	11%
TD	<b>2=Engaged</b>	8	23%
TD	<b>3=High</b>	23	66%
	<b>Total</b>	35	
Autism	<b>1=Low</b>	4	11%
Autism	<b>2=Engaged</b>	9	26%
Autism	<b>3=High</b>	22	63%
	<b>Total</b>	35	



**Figure 37** Pie charts 11 and 12. Participants' interest in tasks and their use of reference points

#### 4.6.9 Time

Documenting the time spent on each task was straightforward. The participants were told that they were about to start being timed and then were timed from when the camera was running. This was important to document, as it helped to illustrate the interest and/or confidence level that each participant had. If there was lots of detail in the illustration and the participant was a fast, confident illustrator, then the time would be looked at, along with the amount of corrections and detail that the

participant added. This allowed the researcher to reach more informed conclusions. Furthermore, if the individual spent only a small amount of time and there was very little detail, then this could be used in the same way.

#### *4.6.9.1 Follow-up questions on completion of the tasks*

The two questions that the students were asked were:

1) When drawing a face, are there any areas that you consider more important to the image than others?

2) When drawing a face, are there any particular details that you spend more time and effort depicting?

These questions were designed to allow the student to express their feelings about what was important to them when drawing a face. The questions asked what features they felt held a picture together and if they focused on some features more than others. The aim of the interviews was to capture whether or not the students themselves would express any feelings about how they constructed a drawn face.



1. The eyes (*highlighted in orange*)
2. The inner face (*highlighted in red*)
3. The outer face (*highlighted in purple*)
4. The hair and ears (*highlighted in blue*)

**Figure 38** The areas that the pupils commented on in their responses

The findings were entered into a tally chart and the results were then compared.

<b>Table 27</b> Interview data from follow-up questions				
	Question 1		Question 2	
AUTISM	Orange	27%	Orange	45%
AUTISM	Red	9%	Red	18%
AUTISM	Purple	36%	Purple	27%
AUTISM	Blue	27%	Blue	9%
	Question 1		Question 2	
TD	Orange	60%	Orange	13%
TD	Red	40%	Red	38%
TD	Purple	0%	Purple	13%
TD	Blue	0%	Blue	38%

Key:

*Orange sections:* eyes and inner eyes

*Red sections:* inner face; nose and mouth

*Purple sections:* outer face; shape of face, beards and any varying details such as dimples or freckles

*Blue sections:* head area; ears, hair, neck and the body

From the initial analysis of the questions, it seems as though those with autism viewed the eyes as an important part of their depiction of faces. Five of the seven autism participants' responses indicated that the eyes were an important part of the face. However, when the questions are looked at separately, a clearer understanding of the responses to them emerges.

#### *4.6.10 Question one*

*When drawing a face, are there any areas that you consider more important to the image than others?*

Far fewer of the pupils with autism considered the eyes to be the most important feature. Instead, the responses varied and were spread out between the eyes, the hair and the shape of the face. The TD participants' responses to this question were more consistent, with 60% saying that they felt the eyes were the most important feature, compared to 27% in the autism group. This suggests that a small majority of TD participants felt that the eyes were the most important feature, and also a combination of the surrounding inner face.

TD participant number 7:

*A – I think eyes, nose and mouth. And basic facial features are more important than stuff like face structure and hair. Because they're more identifiable. Erm, but also eye shape, as they can vary a lot, but also nose shape and whether it's big, round or small.*

Autism participant number 3:

*A – I was saying how I wouldn't ... I would look at the outline because everyone has a different shape of head. And err it would be easier for me to distinguish between people if they were facing away from me because if I'm looking at someone's face, then it would ... I wouldn't be able to see the back ... If I weren't looking at the back of the head I wouldn't know who they were. So, it's easier to see from the back.*

#### 4.6.11 Question two

*When drawing a face, are there any particular details that you spend more time and effort depicting?*

At this point in the interviews, the majority of participants with autism (six out of seven) mentioned that they spent more of their time drawing the eyes. This compares to only one TD pupil answering in this way. This is interesting, because upon examining the results, one can see a large percentage of the pupils with autism (45%) consider the eyes to take the most time when drawing a face. Furthermore, 18% of the participants with autism note that areas such as the inner face are the most important, followed by the outer face at 27% and peripheral features at only 9%. This may suggest that other areas are considered less important to define. However, one could argue that if the interview questions are taken literally, which various studies have indicated people on the autism spectrum have a tendency to do, this could lead to an understanding that eyes are expressed by autistic people to be harder to draw. This may be because the complexities involved in drawing an eye are much harder than other features, for example a nose or an ear.

When we look at the questions separately, there are features that the participants consider more important to the face, although these do not necessarily match the

features that each participant spends time drawing. Far fewer autistic participants consider the eyes to be the most important feature. Indeed, the response is more spread out between the eyes, the hair and the shape of the face, which autistic participants stated are the hardest to depict.

When compared with the TD participants, the responses to the first question are less varied, with the majority stating that they feel that the eyes are the most important feature, together with the surrounding inner face. It is interesting to note that none of the TD participants chose the outer areas of the face when responding to this question, only mentioning the surrounding areas when the second question was asked. At this point in the interviews, the majority of participants with autism then mentioned that they spent more of their time drawing the eyes, with six out of seven participants saying this, compared to only one TD participant.

#### *TD participant 1*

Question 1 – When drawing a face, are there any areas that you consider more important to the image than others?

Answer – Erm, the eyes.

Question 2 – Second question: when drawing faces, are there any particular details that you spend more time and effort depicting?

Answer – The lips.

#### *Autism participant 6*

Question 1 – First question. When drawing a face, are there any areas that you consider more important to the image than others?

Answer – Errrm, head shape.

Question 2 – Cool. Right, next question: when drawing faces, are there any particular details that you spend more time and effort depicting?

Answer – Head shape.

*Autism participant 7*

Question 1 – First question. When drawing a face, are there any areas that you consider more important to the image than others?

Answer – The hair.

Question 2 – Cool. Right, next question: when drawing faces, are there any particular details that you spend more time and effort depicting? So you spend more time on them?

Answer – I think the eyes and for example because they show more emotion.

These results will be considered in the following chapter and implications from the findings will be discussed.

## CHAPTER 5

### 5. Conclusions and implications

#### 5.1 Introduction

This chapter discusses the findings in more detail and is separated into two main sections: key findings in relation to the first research question; and key findings in relation to the second research question. An explanation of the results within the context of the literature is also discussed.

#### 5.2 Key findings in relation to research question 1

##### *5.2.1 A summary of the results*

The results show that there are differences in the behaviour of the two groups. The autism group unanimously started by drawing the outer face in all tasks apart from the cartoon task, whereas just over half the TD group drew the outer face first, and just under half drew the eyes first. The order in which the features were drawn differed between each group depending on what they were asked to draw – for example, when asked to draw a cartoon in comparison to a self-portrait.

The TD participants group consistently followed a similar order in four out of five drawing tasks, whereas the autism group were inconsistent; both from participant to participant and from task to task. The only time this difference between the two groups was not observed was when both groups were asked to draw a cartoon face. The findings also suggest that the TD group gave more attention towards the eyes

than the autism group, although a larger sample would need to be recruited to test the significance of this.

### *5.2.2 Order of the features drawn*

The main difference between the two groups was the priority given to the eyes over other features. The TD group consistently drew the eyes either first or second, sequentially after the outer face was drawn. The TD group always started by either drawing the outer face or eyes. The autism group always drew the outer face first and then were inconsistent, without a clear pattern or priority. There was variation in the priority given to the eyes in the autism group. This is an interesting phenomenon. These findings suggest the importance that each group placed upon the eyes in relation to other features, and indicate that there may be preferences for how each group draws and constructs faces visually.

### *5.2.3 Cartoon drawing task*

The difference seen in the drawing of cartoons was anticipated by this study, given the participants would more likely have drawn such characters recreationally. It was not anticipated that participant's cartoon characters would often merge together faces and bodies. This was due to the participants drawing characters inspired by popular culture, for example Pokémon, an anime inspired range of different fictional creatures. This proved problematic, as students would have had to draw both head

and body. This complication meant that the results from the cartoon drawing task could not be added to the data from the other four tasks.

#### *5.2.4 Level of detail in their drawings*

The drawing of the eyes provided another interesting finding, with 56% of the TD group drew the eyes with higher levels of detail, compared to 23% who drew them with minimal detail; whereas 50% of the autism group drew eyes with a low amount of detail. None achieved the highest level of detail.

The TD group drew the faces with a higher level of detail overall, except for the outer areas that were drawn with less detail than the autism group. The autism group achieved largely consistent detail across all features, with no observable hierarchy of importance. Both the autism group and the TD group gave the first feature drawn no notable elevation in detail in comparison to other features. However, the TD group gave the inner features more detail than the outer areas.

#### *5.2.5 Corrections and the use of a reference point*

There was no significant difference identified between the two groups in terms of corrections or how often they looked up to reference the life model they were drawing. However, there was a difference in the two groups when they were asked the follow-up questions about the drawings they had made.

### *5.2.6 Follow-up questions*

The two questions were designed to extract similar information but coming from different angles. Question one was designed to discover if participants consciously identified parts of the face that demanded more attention, whereas question two was asked from the point of view that there may be a subconscious rather than a conscious draw to some areas.

In response to the first question, the TD group prioritised the eyes, with 60% stating that the eyes were the most important feature, and 40% saying the other inner features. The autism group contrasted, with only 27% identifying the eyes and 9% identifying the inner features. The autism group gave more value to the outer areas of the face, such as the hair and ears, with these areas mentioned by 36%. There was however, no specific preference for any feature overall. The answers to the first question correlate with what is identified in relation to the order and level of detail in the other areas of the study. However, the answers to the second question appear to contradict these findings.

In response to the second question, only 13% of the TD group said eyes were the focus of their effort when drawing faces. The results highlight a spread rather than conscious attentiveness given to one feature. This could suggest that both the inner face and the outer features have equal priority in terms of effort over the shape of the face and the eyes. Alternatively, this could be an example of learnt behaviour resulting from children having been taught how to draw faces, and as a consequence

the outer face was the first feature to be consciously drawn, with the eyes following soon after.

This is also seen in the autism group, with the outer face being drawn first; however, if participants had been following a learnt behaviour, we would expect a similar pattern to how the face was constructed overall. It is only the outer face that was seen to be given this priority by both groups. The answers given by the autism group are also interesting, with just under half stating that they thought they gave the eyes the most attention in order to draw them accurately, and that the other features were given less effort. Both groups contradict the previous findings relating to the level of detail drawn.

The data was collected and analysed by drawing from the researcher's own experiences. This question allowed the participants to express their own feelings around their efforts. The TD group specified that they felt that the inner face and the outer features were the most time consuming and required the most effort to depict. These recordings stir up interesting questions, as they appear to conflict with the answers given to the previous questions.

Are these reversals in their opinions reflecting the importance placed upon each feature? Why spend more time and effort depicting these features if they don't feel they are as important as others? Also, why do we hear a similar change in the autism group? Many of the autism group expressed that this is the hardest feature to draw. Could this show that those with autism are aware of the detail in eyes?

Although the TD group are anecdotally drawn to the eyes, it appears their top-down

processing prevents them from truly seeing the detail in the eye, perhaps meaning that the TD participants were more attracted to this area but saw the eyes less clearly at the same time. Drawing from the literature, it is not surprising that in the TD group the eyes were considered as the most important feature, with the brain redirecting attention away from other features. The TD participants felt that the inner features, nose or hair need more time to depict correctly.

#### *5.2.6.1 Limitations to the follow-up questions*

A significant limitation was that many participants needed the researcher to rephrase the questions, as they did not fully understand the subtle differences between the two questions. This may have contributed to why the qualitative data from this part of the study was also limited. The participants were not actively offering a comprehensive response and it felt unethical to overly prompt them if they were reluctant to offer more detail. The questions were intended to be a participant-led conversation, but in most cases participants chose to end the conversation after answering the immediate question, despite the researcher's prompts and encouragement. There could have been many subjective reasons for this, which could have been explored further if time had allowed. As an example, had the questions been piloted differently such as by using a larger sample of adolescents with autism and typically developing individuals and within different contexts, this may have highlighted the difficulties in how well the questions were formulated. Future research studies could address these issues by taking into account the different levels of anxiety the context and environment raise when piloting the questions. When designing a study it is important to negotiate with the schools to

allow each participant as long as they need for feeding back. This accommodation built into the study design could also generate more robust qualitative data for analysis.

There was also an assumption that the more time and effort spent correlated to the importance given to a particular feature within the overall image. This may not have been the case. However, top-down bottom-up processing might also help explain why participants changed their answers between each follow-up question.

#### *5.2.7 Top-down and bottom-up processing: what do the findings suggest?*

The presence of top-down processing may alter one's perception of what they are drawing, as they draw what they think they see and not what they really see.

Banerjee (2014) argued that it is one's interpretation that is the main cause of error in pictures drawn. This may be an example of participants viewing the eyes as a concept, and drawing from images created in their mind's eye of what they think eyes look like, rather than drawing from what is actually in front of them.

In the TD group the outer face or eyes were drawn first, then the other features would be drawn around these. Perhaps it was at this point that the participants felt their depiction of these later features was more difficult, as they aligned these with the previously drawn features. In the autism group this may appear differently. As discussed previously in Chapter 2, this study anticipated that it would be more likely for individuals with autism to use bottom-up rather than top-down processing, as they

are thought to be less motivated and do not usually show an interest in faces (Chawarska et al., 2010).

The study anticipated that the autism group would draw the eyes as they saw them in relation to other features, giving some explanation as to why the eyes were given far more detail than any other feature on the face. Perhaps this feature, although not prioritised when drawn, would present itself as more difficult to depict without the aid of the top-down mental image of what the eye should look like. TD participants may have been more affected by top-down processing. For example, the top-down understanding of an eye can be represented as a dot; the brain will recognise this as an eye when viewed in relation to other drawn features. The eyes are more successful in triggering this top-down processing, as when two dots are drawn in a pair with a mouth. A nose and a mouth drawn in this simple manner does not invoke the same recognition.



**Figure 39** Two simple depictions of facial features

### **5.3 Summary of findings in relation to question 1**

There are interesting patterns emerging from the data, and the order of features drawn, the levels of detail given to features and the follow-up questions. There is a draw towards the eyes in the TD group that is absent in the autism group, with the autism group appearing more randomised as each participant was drawn to different features.

It is unclear from this study why the autism group consistently drew the outer face sequentially first, or why there is a strong tendency in TD to do the same. A follow-up study could look at how many TD draw the outer face and how many start with the eyes, as these were the only two features that any participant started with.

### **5.4 Key findings in relation to research question 2**

This study identified five key findings, which will now be discussed in more detail.

#### *5.4.1 A lack of draw to the eyes*

These findings agree with much of the current research on eye tracking and the literature review by Golarai et al. (2006). Although the evidence is not statistically significant, when looking in depth and comparing all areas of the study, the data supports evidence of a bias in TD towards the eyes, with no observed draw seen in the autism group. There are implications for individuals with autism if they are not

responding to eye contact from others and are not being drawn towards the eyes in a similar way. Golarai et al. (2006) suggested that this draw allows for emotional understanding to be archived in children. Without the ability to look in the right place, and thereby to be able to archive a significant library of emotional communication that is collected from the face, a child's ability to recognise and understand facial emotional communication will be significantly affected.

#### *5.4.2 Random eye tracking*

The second finding of note was that participants with autism constructed their portraits in a much more random manner, but only after initially drawing the outer face. As discussed, Golarai et al.'s study (2006) found that when eyes had been tracked, TD participants would draw, with their eyes, a triangle shape from both eyes down to the mouth. A possible bias in TD participants towards the eyes was seen in this study, with the eyes being drawn sooner and in more detail, and being more integral than other features; however, there was not a clear pattern in how TD participants constructed their images. There is potentially more of a pattern in the TD images than in the autism images, but the results cannot be conclusive due to the sample size. There was no evidence that the autism peers identify the eyes as an important feature, with the eyes falling into place alongside any other feature and with no identifiable importance given to them.

This conforms with Golarai et al.'s study (2006). They observed that the eye tracking of a face in autism is more random, with each participant in the autism group

differing from each other and not following their peers in drawing the features in a particular order or finding an area more attractive than another. This finding also fits with Chawarska et al.'s (2010) study, which found a clear difference in how toddlers with autism scan faces. This particular study found that toddlers with autism scan their environment in an unbiased way between faces and objects, although it is unclear in the study whether the participants with autism had an associated deficit in held attention level in relation to faces. This lack of bias between faces and objects may be what is seen in Golarai et al.'s study and in the present study.

The present study also supports the findings of Pelphrey et al. (2002), who established that TD individuals process detail by honing their scanning to particular inner details of the face.

#### *5.4.3 Problem of local facial processing*

As discussed in Chapter 2, weak central coherence is a theory that suggests a strong bias towards local processing. Enhanced perceptual functioning attempts to expand upon this by suggesting there is no deficit in global processing in autism. This study found evidence that there is a pattern in the execution of the tasks, as both the autism and TD participants started their drawings more often with the outer face. The autism group drew the outer face at the start of almost every image; the only exception to this was when they drew cartoons.

This finding supports Dakin and Frith's (2005) literature review, which found evidence that autism and the social deficit seen may not be due to an inability to prioritise social cues on a global level, but might rather be a more astute problem in local processing of facial stimuli. Similarly, Pelphrey et al. (2002) established that typically developing individuals process detail by localising their scan to inner details of the face. Both these studies found evidence that fits with this study's observations of TD participants focusing on the eyes and the autism group not doing this.

As discussed, strong evidence was found of superior processing of fine detail, but in many current studies there was a lack of evidence to determine a weakness of global processing, with participants preferring to focus on details of a stimulus rather than global processing. However, many of these studies gave participants a choice of either processing local detail or processing globally. Although the present study finds that there is evidence of a bias towards the eyes in TD participants, there is not a preserved bias towards fine detail in participants with autism. There was no clear difference between the two groups in the level of detail given to any feature other than the eyes.

The present study's results complement Koldewyn et al. (2013), who suggested there is a tendency for a more local processing style, but also that individuals with autism show a disinclination, and not a disability, in global processing. However, there is little evidence of a bias towards local processing, which is seen in other studies using objects as points of reference instead of faces. The current study found that the TD group outperformed the autism group in the level of detail drawn in the features, and the TD participants did draw the eye with more detail than the autism

participants. However, as the two groups were not matched for ability it is not possible to draw any conclusions from this finding.

#### *5.4.4 This study does not support the view of a bias towards fine detail in autism*

The results conflict with many of the research papers, which suggest that there is a bias towards fine detail in autism. As an example, studies like that of Neumann et al. (2011), who say autism participants demonstrate an “intact or superior local processing of visual-spatial tasks”, with a potential to outperform typically developing controls in local processing.

This study combined two methods of data collection by asking participants to draw faces rather than objects and by documenting how these images were constructed. This was identified as a gap in the methods used in the current literature. Asking participants to draw faces instead of objects may have resulted in the TD participants localising their processing to fine detail in relation to the eyes. In a comparison of the autism and TD groups, this study suggests that the autism participants do not have the same response of intense focusing on the detail of the eyes and inner face, which appears to challenge the theorised bias towards fine detail in autism.

These findings conflict with studies like that of Neumann et al. (2011), who say autism participants demonstrate an “intact or superior local processing of visual-spatial tasks”, with a potential to outperform typically developing controls in local processing.

The findings suggest a global processing of faces in the autism group. Also, none of the TD participants said that they were drawn to global features or showed a draw towards them in their construction of drawn faces; they all favoured the eyes and the inner face features. This evidence does not support WCC bias towards local processing in autism. The evidence collected in this study leans towards a potential global processing of faces in autism.

Although this appears to disagree with WCC and EPF, Frith (1991) argued that people with autism were more able than TD individuals to see the fine detail and stated that not processing information globally was a tendency, and not an inability. Thus, what this study suggests is that those with autism also process faces differently to other objects, in this case adopting, at least in the immediate beginning of a drawing, a more global processing preference.

The TD group is less consistent, with more starting the drawing with the outer face. The eyes have a stronger hold over attention and draw TD participants into a local processing style, as attention is directed towards the eyes sooner, and there are higher levels of detail when drawing the eyes. This is not seen in the autism group. This evidence could again support the theory that individuals with autism process faces more globally and that TD individuals process them more locally. This would fit within EPF theories of visual processing, as it suggests that there is a disinclination towards global processing and not a disability. Due to the lack of evidence on global and local processing of faces found by this study's literature search, these findings can fit within EPF's framework and again within WCC.

Happé and Booth (2008) highlighted in their literature review that studies they had found were not designed to test global and local processing effectively. They pointed out that studies did not equally test both global and local processing. As mentioned in Chapter 2, there were no studies found that attempted to test these findings using faces as a stimulus. Therefore, the current study could show that these behaviours of visual processing may be more flexible than previously thought, depending on the stimulus.

#### *5.4.5 Differences seen in relation to top-down bottom-up processing*

As outlined previously in this study, there are many areas of face processing that need to be present in awareness when studying this phenomenon. Top-down and bottom-up is one processing style that should not be forgotten.

The pattern of the outer face being drawn first can be questioned. This might be explained by how schools teach children to draw. For example, are children encouraged to draw a circle to measure the face and line this up to each feature? More evidence is needed to draw significant conclusions in this area, as one would expect to see that this would be similar in both groups. However, in the follow-up questions, autism participants said that the shape of the face/head is important, as evidenced by the following statement.

*Autism participant 3: "I would look at the outline because everyone has a different shape of head. And, er, it would be easier for me to distinguish between people if they were facing away from me, because if I'm looking at someone's face, then it*

*would ... I wouldn't be able to see the back ... If I weren't looking at the back of the head, I wouldn't know who they were. So it's easier to see from the back."*

*TD participant 7*

*Q1 – When drawing a face, are there any areas that you consider more important to the image than others?*

*A – I think eyes, nose and mouth. And basic facial features are more important than stuff like face structure and hair. Because they're more identifiable. Erm, but also eye shape, as they can vary a lot, but also nose shape and whether it's big, round or small.*

## **5.5 ideas for further research**

When compared to the current literature, the study identified five key findings, as follows:

1. A lack of draw towards the eyes

This study supports the theory that a lack of draw towards the eyes is seen in autism, although there is less significant evidence of a draw to the inner face.

2. Random eye tracking

This study supports Golarai et al.'s (2006) observation that eye tracking of a face in autism is more random.

### 3. Problem of local facial processing

This study supports Dakin and Frith's (2005) literature review, evidencing that the social deficit seen in autism may not be because of an inability to prioritise social cues on a global level, but might rather be a more astute problem in local processing of facial stimuli.

### 4. This study does not support the current view that there is a bias towards local fine detail processing in autism and a deficit in global processing.

### 5. This study has identified a difference in top-down bottom-up processing of eyes between the two groups, which may be worth exploring in further studies.

#### 5.5.1 Limitations of the study

Three main limitations to this study have been identified. The first is concerned with the relationship between the researcher and the participants. The findings have been overly reliant on quantitative data as it was not possible to capture a significant amount of qualitative feedback from the participants. This is due to a limitation within the study design that did not anticipate the lack of feedback as a potential limitation to the study. There would have been a degree of anxiety for all 14 participants, given that they had not met the researcher, and were not sure of what was going to be asked of them. Individuals with autism are much more likely to be significantly affected by their environment, more so than their TD peers, especially when working in an unfamiliar setting. Their stress levels can be impacted if familiar settings have

been altered or if their routine is changed and they are moved from their expected setting to another one – for example, if, as in this research, they are taken from their usual classroom to another. As a result, there will be a change in how they process their environment, as they will no longer be in a typical calm state. Anxiety may also have been created by the participants' awareness that their illustrations were being video recorded. Although the participants' faces were not recorded, having a camera record their drawings might still have led to an increase in their anxiety levels.

In future studies, it would be beneficial to reduce as far as possible these potential causes of anxiety. This study needed to work within a school timetable and was confined by needing to work with teachers. This meant that the study needed to remove students from their normal class, and ask them to do an activity that was outside the normal classroom context, did not follow their usual timetable and was away from their peers. Structuring the task to take place within their normal art classes could reduce disruption to the normal daily routine. The use of more advanced technology is another possible solution that could help reduce anxiety for future studies.

By utilising current technology, such as a tablet that is operating custom software specifically designed to record the participant's procedure of making the illustrations, the illustrations could be recorded digitally. This would remove the need for a camera to record the participants themselves, likely reducing their awareness as well as any resultant anxiety around being recorded. These recommendations could not be achieved in this study due to the limited budget and the need to work with schools.

The second significant limitation was the nature and size of the sample of participants. The sample size was small, while the diagnosis of the participants with autism was not checked or confirmed due to the restricted access to student records, as agreed by the schools' head teachers. In addition, due to the nature of the research, perfect matching of the seven participants in each group was not possible. Assessing the artistic adeptness and education in the two groups was problematic due to the limited access to the participants. The researcher relied primarily on the help of the school staff involved. In future studies, it would be desirable for further information to be sought on the participants' intellectual and verbal ability, their previous art education, and their autism diagnosis. It would also be helpful to access a much larger number of students from more schools. This study was unable to achieve a larger amount of participants due to the limitations of manpower, as only the researcher himself was involved in contacting schools. Due to this, the sample size was limited in scope.

Another limitation was the fact that there was only one task where all 14 participants drew the same face (from the photograph), which made the comparisons of their drawings more difficult. In future studies, this could be addressed by asking all the participants to draw the same life model. A future study could also rearrange the order in which the participants draw each image and ask the participants to draw the life model first, and then at a later point in the study ask them to draw the same life model from memory. This would then mean that all participants would be drawing the same individual for the researcher to review. Using the same life model was not possible for this study due to schools only allowing the researcher to have access to the pupils due to the number of teachers available and willing to accompany the researcher during the study. A closer relationship with schools is recommended and

more consideration of the amount of time needed particularly if qualitative data is to be included in a future study.

In order to reduce the effect of using a video recorder, the research could have been designed within an art class and they could have used computer tablets, which would have recorded each mark made by each student. This would have reduced the contact the researcher needed to have with students, as notes could have been collected afterwards by viewing the illustrations on the screen. However, due to the research being self-funded and needing to fit within the school's parameters, this was not possible at the time this study was carried out.

#### 5.5.2 Next steps

The findings from this study were not specifically designed to be translated into generalised practice as the sample size used was not large enough, the qualitative data was not readily available and as a result the study relies heavily on quantitative findings. However, the implications for practice are an important aspect ensuring that future studies are designed to explore in more detail and add to the understanding of how to develop support for children identified as being at risk of having autism.

Scholars with an interest in understanding the implications of nonverbal communications such as eye gaze and how individuals process emotional communication from the face is debated within the field. Research focusing on visual processing with a larger sample size, with the opportunity to collate richer qualitative data and research including sensory sensitivities are areas that would benefit from further exploration. The importance of hearing the voices of individuals with a diagnosis of autism is also important in order to ensure any findings can be meaningful for the population they are designed to support. Without appropriate

support, a child's ability to recognise and understand facial emotional communication will be significantly affected. Further research in this area would enable educators and other health and social care professionals to address this weakness at an early age to potentially reduce the impact on the child's development and social awareness.

Word count 19886 (excluding tables and figures)

## References and bibliography

APA 1994. DSM-IV *Diagnostic and Statistical Manual of Mental Disorders (4th edn)*. American Psychiatric Association: Washington, DC

Amestoy, A., Guillaud, E., Bouvard, M.P. & Cazalets, J. 2015, "Developmental changes in face visual scanning in autism spectrum disorder as assessed by data-based analysis", *Frontiers in psychology*, vol. 6, pp. 989.

Ashwin, C., Wheelwright, S. & Baron-Cohen, S. 2005, "Laterality Biases to Chimeric Faces in Asperger Syndrome: What is Right About Face-Processing?", *Journal of Autism and Developmental Disorders*, vol. 35, no. 2, pp. 183-196.

Ashwin, C., Wheelwright, S. & Baron-Cohen, S. 2006, "Finding a face in the crowd: Testing the anger superiority effect in Asperger Syndrome", *Brain and Cognition*, vol. 61, no. 1, pp. 78-95.

Banerjee, S., Frey, H., Molholm, S. & Foxe, J.J. 2015, "Interests shape how adolescents pay attention: the interaction of motivation and top-down attentional processes in biasing sensory activations to anticipated events", *European Journal of Neuroscience*, vol. 41, no. 6, pp. 818-834.

Banks, M., 2001. *Visual Methods in Social Research*. London: Sage Publications

Baron-Cohen., S & Bolton, P., 1993. *Autism The Facts Oxford*: Oxford University Press.

Becker, H.S., 1974. Photography and Sociology. *Studies in Visual Anthropology of Visual Communication*. Vol. 1, No.1. pp3 -26

Bell, J., (2005) *Doing Your Research Project Fourth Edition* Maidenhead: Open University Press McGraw-Hill Education

- Bell, P., 2011. *Content Analyses of Visual Images* in Van Leewen, T., Jewitt, C. eds. 2011. *Handbook of Visual Analysis* London: Sage Publications (first published in 2001)
- Berger, J., 1972. *Ways of Seeing* London: British Broadcasting Corporation and Penguin Books
- Bernardino, I., Mouga, S., Almeida, J., van Asselen, M., Oliveira, G. & Castelo-Branco, M. 2012, "A direct comparison of local-global integration in autism and other developmental disorders: implications for the central coherence hypothesis", *PloS one*, vol. 7, no. 6, pp. e39351.
- Blaikie, N., 2000. *Designing Social research* Cambridge: Polity Press
- Booth, R., Charlton, R., Hughes, C. & Happé, F. 2003, "Disentangling weak coherence and executive dysfunction: planning drawing in autism and attention-deficit/hyperactivity disorder", *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences*, vol. 358, no. 1430, pp. 387-392.
- Brosnan, M.J., Scott, F.J., Fox, S. & Pye, J. 2004, "Gestalt processing in autism: failure to process perceptual relationships and the implications for contextual understanding", *Journal of Child Psychology and Psychiatry*, vol. 45, no. 3, pp. 459-469.
- Chakrabarti, B., Bullmore, E. & Baron-Cohen, S. 2006, "Empathizing with basic emotions: Common and discrete neural substrates", *Social Neuroscience*, vol. 1, . 3-4, pp. 364-384.
- Chamberlain, R., McManus, I.C., Riley, H., Rankin, Q. & Brunswick, N. 2013, "Local processing enhancements associated with superior observational drawing are due to enhanced perceptual functioning, not weak central coherence", *Quarterly journal of experimental psychology (2006)*, vol. 66, no. 7, pp. 1448
- Chawarska, K. & Shic, F. 2009, "Looking but not seeing: atypical visual scanning and recognition of faces in 2 and 4-year-old children with autism spectrum disorder", *Journal of autism and developmental disorders*, vol. 39, no. 12, pp. 1663.
- Cheng, Y.B., Salleh, A. and Jusoff, K., 2011. Portrait Drawings Therapy: Windows of Hope for Children with Autism Spectrum Disorder. *World Applied Sciences Journal (Learning Innovation and Intervention for Diverse Learners)*, (14), pp.44-51.
- Cohen, D.J. and Bennett, S., 1997. Why can't most people draw what they see?. *Journal of Experimental Psychology: Human Perception and Performance*, 23(3), p.609.
- Cohen, D.J. 2005, "Look little, look often: The influence of gaze frequency on

- drawing accuracy", *Perception & Psychophysics*, vol. 67, no. 6, pp. 997-1009.
- Collins., 2003. *Concise Dictionary & Thesaurus – Three Books in One. Third edition* Glasgow: HarperCollins publishers (First Published in 1991)
- Cox, M. & Eames, K. 1999, "Contrasting Styles of Drawing in Gifted Individuals with Autism", *Autism*, vol. 3, no. 4, pp. 397-409.
- Creswell, J. W., & Plano Clark, V.L. 2011. *Designing and conducting mixed methods research* London: Sage Publications
- Dakin, S. and Frith, U., 2005. Vagaries of visual perception in autism. *Neuron*, 48(3), pp.497-507.
- De Jong, M. 2008, "Attentional effects of gaze shifts are influenced by emotion and spatial frequency, but not in autism", *J Am Acad Child Adolesc Psychiatry*, vol. 47, no. 4, pp. 443-454.
- De Vaus, D.A., 2005. *Research Design in Social Science* London: Sage Publications Ltd
- Drake, J.E., Redash, A., Coleman, K., Haimson, J. & Winner, E. 2010, "'Autistic' local processing bias also found in children gifted in realistic drawing", *Journal of autism and developmental disorders*, vol. 40, no. 6, pp. 762-773.
- Drake, J.E. & Winner, E. 2011, "Superior Visual Analysis and Imagery in an Autistic Child with Drawing Talent", *Imagination, Cognition and Personality*, vol. 31, no. 1, pp. 9-29.
- Eigsti, I.M., Schuh, J., Mencl, E., Schultz, R.T. & Paul, R. 2012, "The neural underpinnings of prosody in autism", *Child Neuropsychology*, vol. 18, no. 6, pp. 600-617.
- Faja, S., Webb, S.J., Merkle, K., Aylward, E. & Dawson, G. 2009, "Brief Report: Face Configuration Accuracy and Processing Speed Among Adults with High-Functioning Autism Spectrum Disorders", *Journal of Autism and Developmental Disorders*, vol. 39, no. 3, pp. 532-538
- Foss-Feig, J.H., Tadin, D., Schauder, K.B. & Cascio, C.J. 2013, "A substantial and unexpected enhancement of motion perception in autism", *The Journal of neuroscience : the official journal of the Society for Neuroscience*, vol. 33, no. 19, pp. 8243.
- Gliga, T., Bedford, R., Charman, T., Johnson, M., Baron-Cohen, S., Bolton, P., Cheung, C., Davies, K., Liew, M., Fernandes, J., Gammer, I., Maris, H., Salomone, E., Pasco, G., Pickles, A., Ribeiro, H., Tucker, L. & BASIS Team 2015, "Enhanced Visual Search in Infancy Predicts Emerging Autism Symptoms", *Current Biology*, vol. 25, no. 13, pp. 1727-1730.
- Golarai, G., Grill-Spector, K. & Reiss, A.L. 2006, "Autism and the development of

- face processing", *Clinical Neuroscience Research*, vol. 6, no. 3, pp. 145-160.
- Greene, J. 2007. *Mixed methods in social inquiry*. San Francisco, CA: Jossey-Bass.
- Happé, F.G.E. & Booth, R.D.L. 2008, "The power of the positive: Revisiting weak coherence in autism spectrum disorders", *The Quarterly Journal of Experimental Psychology*, vol. 61, no. 1, pp. 50-63.
- Hart, C., 2005. *Doing your masters Dissertation* London: Sage Publications Ltd
- Holmes, A., Mogg, K., Garcia, L.M. & Bradley, B.P. 2010, "Neural activity associated with attention orienting triggered by gaze cues: *A study of lateralized ERPs*", *Social Neuroscience*, vol. 5, no. 3, pp. 285-295.
- Jiang, Y.V., Capistrano, C.G., Esler, A.N. & Swallow, K.M. 2013, "Directing Attention Based on Incidental Learning in Children With Autism Spectrum Disorder", *Neuropsychology*, vol. 27, no. 2, pp. 161-169.
- Jolley, R.P., O'Kelly, R., Barlow, C.M. & Jarrold, C. 2013, "Expressive drawing ability in children with autism", *The British journal of developmental psychology*, vol. 31, no. Pt 1, pp. 143-149.
- Jones, W., Carr, K. & Klin, A. 2008, "Absence of Preferential Looking to the Eyes of Approaching Adults Predicts Level of Social Disability in 2-Year-Old Toddlers With Autism Spectrum Disorder", *Archives of General Psychiatry*, vol. 65, no. 8, pp. 946-954.
- Katarzyna, C., Fred, V. & Ami, K. 2010, "Limited Attentional Bias for Faces in Toddlers With Autism Spectrum Disorders", *Archives of General Psychiatry*, vol. 67, no. 2, pp. 178-185.
- Kierkegaard, S in Mills, R., 2013. *"Trouble" Reducing the Risk* Swindon: Presentation by the National Autistic Society and Research Autism
- Kikuchi, Y., Senju, A., Hasegawa, T., Tojo, Y. & Osanai, H. 2013, "The effect of spatial frequency and face inversion on facial expression processing in children with autism spectrum disorder", *Japanese Psychological Research*, vol. 55, no. 2, pp. 118-130.
- Klin, A., Jones, W., Schultz, R., Volkmar, F. & Cohen, D. 2002, "Visual Fixation Patterns During Viewing of Naturalistic Social Situations as Predictors of Social Competence in Individuals With Autism", *Archives of General Psychiatry*, vol. 59, no. 9, pp. 809-816.
- Klin, A. & Jones, W. 2008, "Altered face scanning and impaired recognition of biological motion in a 15-month-old infant with autism", *Developmental Science*, vol. 11, no. 1, pp. 40-46.
- Koh, H.C., Milne, E. & Dobkins, K. 2010, "Spatial contrast sensitivity in adolescents

with autism spectrum disorders", *Journal of autism and developmental disorders*, vol. 40, no. 8, pp. 978-987

Koldewyn, K., Jiang, Y.V., Weigelt, S. & Kanwisher, N. 2013, "Global/Local Processing in Autism: Not a Disability, but a Disinclination", *Journal of Autism and Developmental Disorders*, vol. 43, no. 10, pp. 2329-2340.

Kuschner, E.S., Bodner, K.E. & Minshew, N.J. 2009, "Local vs. global approaches to reproducing the Rey Osterrieth Complex Figure by children, adolescents, and adults with high-functioning autism", *Autism research : official journal of the International Society for Autism Research*, vol. 2, no. 6, pp. 348-n/a.

Lincoln, Y., and Tierney, W.G., 2004. Qualitative Research and Institutional Review Boards. *Qualitative Inquiry Vol 10, No 2 pp219-234*. in Prosser, J., Loxley, A. 2008. *Introducing Visual Methods ESRC National Centre for Research Methods*. NCRM Review Paper

MacDougall, D., 1997. *The Visual in Anthropology* in Banks, 2001. *Visual Methods in Social Research*. London: Sage Publications

Martin, N. 2008, "Assessing Portrait Drawings Created by Children and Adolescents With Autism Spectrum Disorder", *Art Therapy*, vol. 25, no. 1, pp. 15-23.

Meaux, E. , Bakhos, D. , Bonnet-Brilhault, F. , Gillet, P. , Lescanne, E. , Barthélémy, C. & Batty, M. (2014). "Please Draw Me a Face..." Atypical Face Mental Concept in Autism. *Psychology*, 5, 1392-1403.  
*doi: 10.4236/psych.2014.511150.*

Merleau-Ponty, M., 2002. *Phenomenology of Perception* Abington, Oxon: Routledge Classics (Reprint 2010. First published in 1945 by Gallimard, Paris)

Mottron, L., & Burack, J. (2001). Enhanced Perceptual Functioning in the Development of Autism. In J. A. Burack, T. Charman, N. Yirmiya, & P. R. Zelazo (Eds.), *The Development of Autism: Perspectives from Theory and Research* (pp. 131-148). Mahwah, NJ: Erlbaum.

Mottron, L., Dawson, M., Soulières, I., Hubert, B. & Burack, J. 2006, "Enhanced Perceptual Functioning in Autism: An Update, and Eight Principles of Autistic Perception", *Journal of Autism and Developmental Disorders*, vol. 36, no. 1, pp. 27-43.

Mottron, L., Mineau, S., Martel, G., Bernier, C.S., Berthiaume, C., Dawson, M., Lemay, M., Palardy, S., Charman, T. & Faubert, J. 2007, "Lateral glances toward moving stimuli among young children with autism: Early regulation of locally oriented perception?", *Development and Psychopathology*, vol. 19, no. 1, pp. 23-36.

Navab, A., Gillespie-Lynch, K., Johnson, S.P., Sigman, M. & Hutman, T. 2012, "Eye-

Tracking as a Measure of Responsiveness to Joint Attention in Infants at Risk for Autism: JOINT ATTENTION IN HIGH-RISK INFANTS", *Infancy*, vol. 17, no. 4, pp. 416-431.

Neumann, N., Dubischar-Krivec, A.M., Poustka, F., Birbaumer, N., Bölte, S. & Braun, C. 2011, "Electromagnetic evidence of altered visual processing in autism", *Neuropsychologia*, vol. 49, no. 11, pp. 3011-3017

New, J.J., Schultz, R.T., Wolf, J., Niehaus, J.L., Klin, A., German, T.C. & Scholl, B.J. 2010, "The scope of social attention deficits in autism: Prioritized orienting to people and animals in static natural scenes", *Neuropsychologia*, vol. 48, no. 1, pp. 51-59.

Nguyen, A., 2008. *Environment and surroundings: how to make them autism-friendly*. London: The National Autistic Society.

Oxford dictionaries <http://www.oxforddictionaries.com> (date accessed January 24<sup>th</sup> 2015)

Pelphrey, K.A., Sasson, N.J., Reznick, J.S., Paul, G., Goldman, B.D. & Piven, J. 2002, "Visual Scanning of Faces in Autism", *Journal of Autism and Developmental Disorders*, vol. 32, no. 4, pp. 249-261.

Perri, G & Bellamy, C., 2012. *Principles of methodology – Research Design in social science* London: Sage Publications Ltd

Pring, L., Ryder, N., Crane, L. & Hermelin, B. 2010, "Local and Global Processing in Savant Artists with Autism", *Perception*, vol. 39, no. 8, pp. 1094-1103.

Prosser, J., Loxley, A., 2008. Introducing Visual Methods *ESRC National Centre for Research Methods*. NCRM Review Paper

Remington, A.M., Swettenham, J.G. & Lavie, N. 2012, "Lightening the load: perceptual load impairs visual detection in typical adults but not in autism", *Journal of abnormal psychology*, vol. 121, no. 2, pp. 544-551.

Rice, K., Moriuchi, J.M., Jones, W. & Klin, A. 2012, "Parsing Heterogeneity in Autism Spectrum Disorders: Visual Scanning of Dynamic Social Scenes in School-Aged Children", *Journal of the American Academy of Child & Adolescent Psychiatry*, vol. 51, no. 3, pp. 238-248.

Richmond, L.L., Thorpe, M., Berryhill, M.E., Klugman, J. & Olson, I.R. 2013, "Individual differences in autistic trait load in the general population predict visual working memory performance", *Quarterly journal of experimental psychology (2006)*, vol. 66, no. 6, pp. 1182.

Robson, C., 2002. *Real World Research second edition* Oxford: Blackwell Publishing

Rose, G., 2001. *Visual Methodologies: An Introduction to the Interpretation of Visual*

Material London: Sage Publications

Saussure, Ferdinand de., {1916} 1974. Course in General Linguistics (trans. Wade Baskin). London: Fontana/Collins in Rose, G (2001) Visual Methodologies: An Introduction to the Interpretation of Visual Material London: Sage Publications

Sheppard, E., Ropar, D. & Mitchell, P. 2007, "The Impact of Meaning and Dimensionality on Copying Accuracy in Individuals with Autism", *Journal of Autism and Developmental Disorders*, vol. 37, no. 10, pp. 1913-1924.

Sheppard, E., Ropar, D. & Mitchell, P. 2009, "Drawing the Line: How People with Autism Copy Line Drawings of Three-Dimensional Objects", *Perception*, vol. 38, no. 7, pp. 1104-1106.

Sheppard, E., Ropar, D. & Mitchell, P. 2009, "Perceiving the impossible: How individuals with autism copy paradoxical figures", *Autism*, vol. 13, no. 4, pp. 435-452.

Sheppard, E., Ropar, D. & Mitchell, P. 2009, "Autism and dimensionality: differences between copying and drawing tasks", *Journal of autism and developmental disorders*, vol. 39, no. 7, pp. 1039-1046.

Silverman, D. (2005). *Doing qualitative research; a practical handbook*, 2d ed. London: Sage Publications

Snow, J., Ingeholm, J.E., Levy, I.F., Caravella, R.A., Case, L.K., Wallace, G.L. & Martin, A. 2011, "Impaired Visual Scanning and Memory for Faces in High-Functioning Autism Spectrum Disorders: It's Not Just the Eyes", *Journal of the International Neuropsychological Society*, vol. 17, no. 6, pp. 1021-1029.

Southgate, V. & de C. Hamilton, Antonia F 2008, "Unbroken mirrors: challenging a theory of Autism", *Trends in Cognitive Sciences*, vol. 12, no. 6, pp. 225-229.

Stanyer, P & Rosenberg, T., 2006. A Foundation Course in Drawing London: Arcturus Publishing Ltd

Swetnam, D., & Swetnam, R., 2010. Writing your Dissertation – The best selling guide to planning, preparing and presenting first –class work 3<sup>rd</sup> edition Oxford: How To books Ltd (*Third edition first published 2000*)

Tashakkori, A. and Teddlie, C. eds., 2010. *Sage handbook of mixed methods in social & behavioral research*. Sage.

Tate Gallery Online. <http://www.tate.org.uk/learn/online-resources/glossary/t/tone> (date accessed January 24<sup>th</sup> 2015)

Tchalenko, J., Dempere-Marco, L. Hu, G. Z. & Yang, X. P., 2003. Eye Movement and Voluntary Control in Portrait Drawing In The Mind's Eye: Cognitive and Applied Aspects of Eye Movement Research Elsevier Science Ltd.

Thomas, G., 2013. How to do your Research Project – a guide for students in

*education and applied social sciences second edition* London: Sage Publications (first edition published 2009)

Van De Vall, R., 2008. *At the Edges of Vision - A Phenomenological Aesthetics of Contemporary Spectatorship* Aldershot: Ashgate Publishing Ltd

Van Leewen, T. and Jewitt, C. eds., 2001. *The Handbook of Visual Analysis* London: Sage Publications

Vladeanu, M., Monteith-Hodge, E.M. & Bourne, V.J. 2012;2011;, "Strength of lateralisation for processing facial emotion in relation to autistic traits in individuals without autism", *Laterality: Asymmetries of Body, Brain and Cognition*, vol. 17, no. 4, pp. 438-15.

Vlamings, Petra Hendrika Johanna Maria, Jonkman, L.M., van Daalen, E., van der Gaag, Rutger Jan & Kemner, C. 2010, "Basic Abnormalities in Visual Processing Affect Face Processing at an Early Age in Autism Spectrum Disorder", *Biological Psychiatry*, vol. 68, no. 12, pp. 1107-1113.

Von dem Hagen, Elisabeth A.H, Stoyanova, R.S., Rowe, J.B., Baron-Cohen, S. & Calder, A.J. 2014, "Direct Gaze Elicits Atypical Activation of the Theory-of-Mind Network in Autism Spectrum Conditions", *Cerebral Cortex*, vol. 24, no. 6, pp. 1485-1492.

Vuilleumier, P., Driver, J., Armony, J.L. & Dolan, R.J. 2003, "Distinct spatial frequency sensitivities for processing faces and emotional expressions", *Nature Neuroscience*, vol. 6, no. 6, pp. 624-631.

Wagner, J., 1979. *Images of Information: still Photography in the social Sciences* Sage: Beverley Hills

Williams, D., 1996. *Autism An Inside-Out Approach* London: Jessica Kingsley Publishers Ltd

Wing, L, Ed., 1988. *Aspects of Autism: Biological Research* Oxford: Alden Press (Proceedings of a conference held at the university of Kent, 18-20 September, 1987 Gaskell Royal College of Psychiatrists/The National Autistic Society)

Wyer, N.A., Martin, D., Pickup, T. & Neil Macrae, C. 2012, "Individual Differences in (Non-Visual) Processing Style Predict the Face Inversion Effect", *Cognitive Science*, vol. 36, no. 2, pp. 373-384.

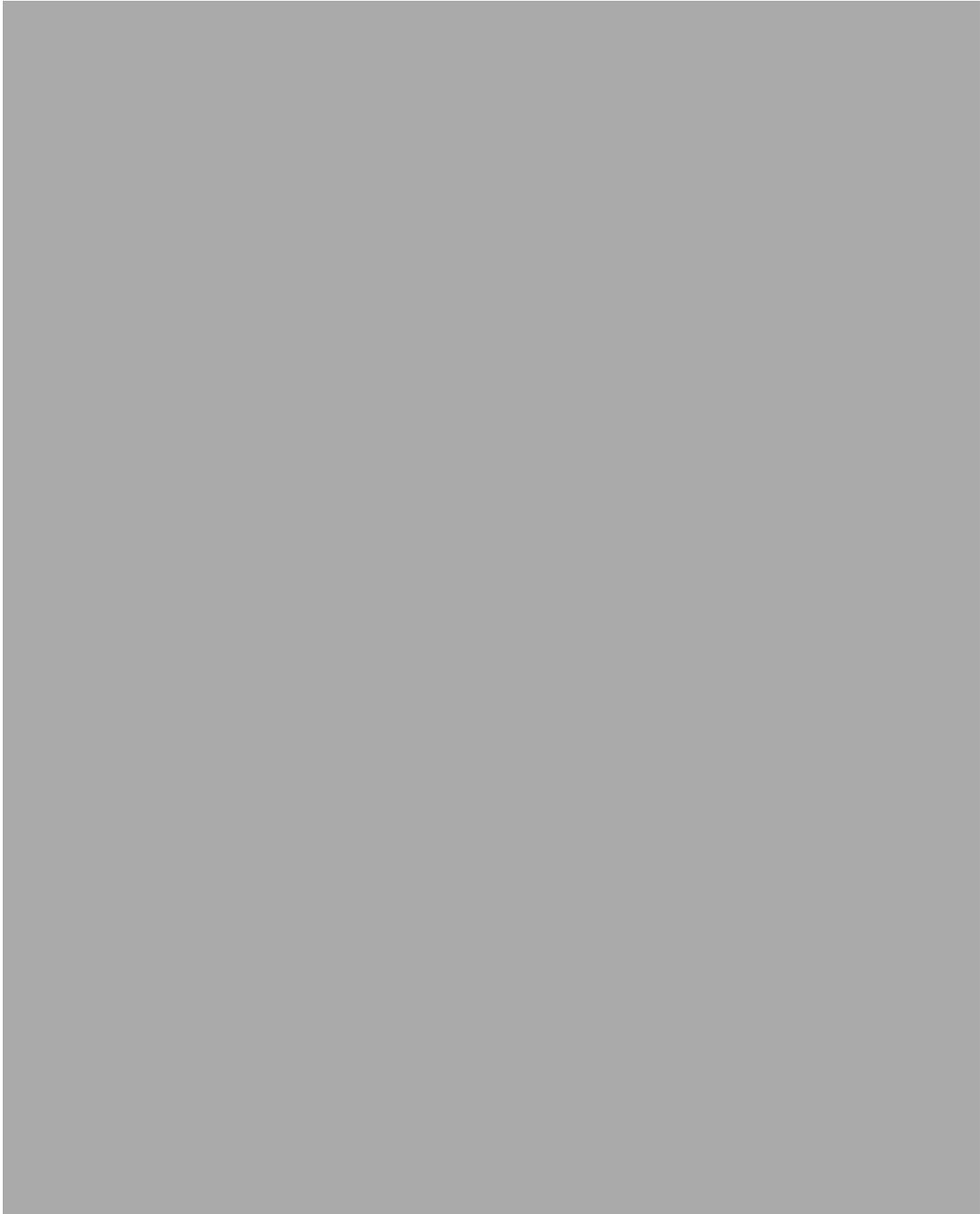
Yin, R, K., 2013. *Applications of case Study Research*. London: Sage Publications.

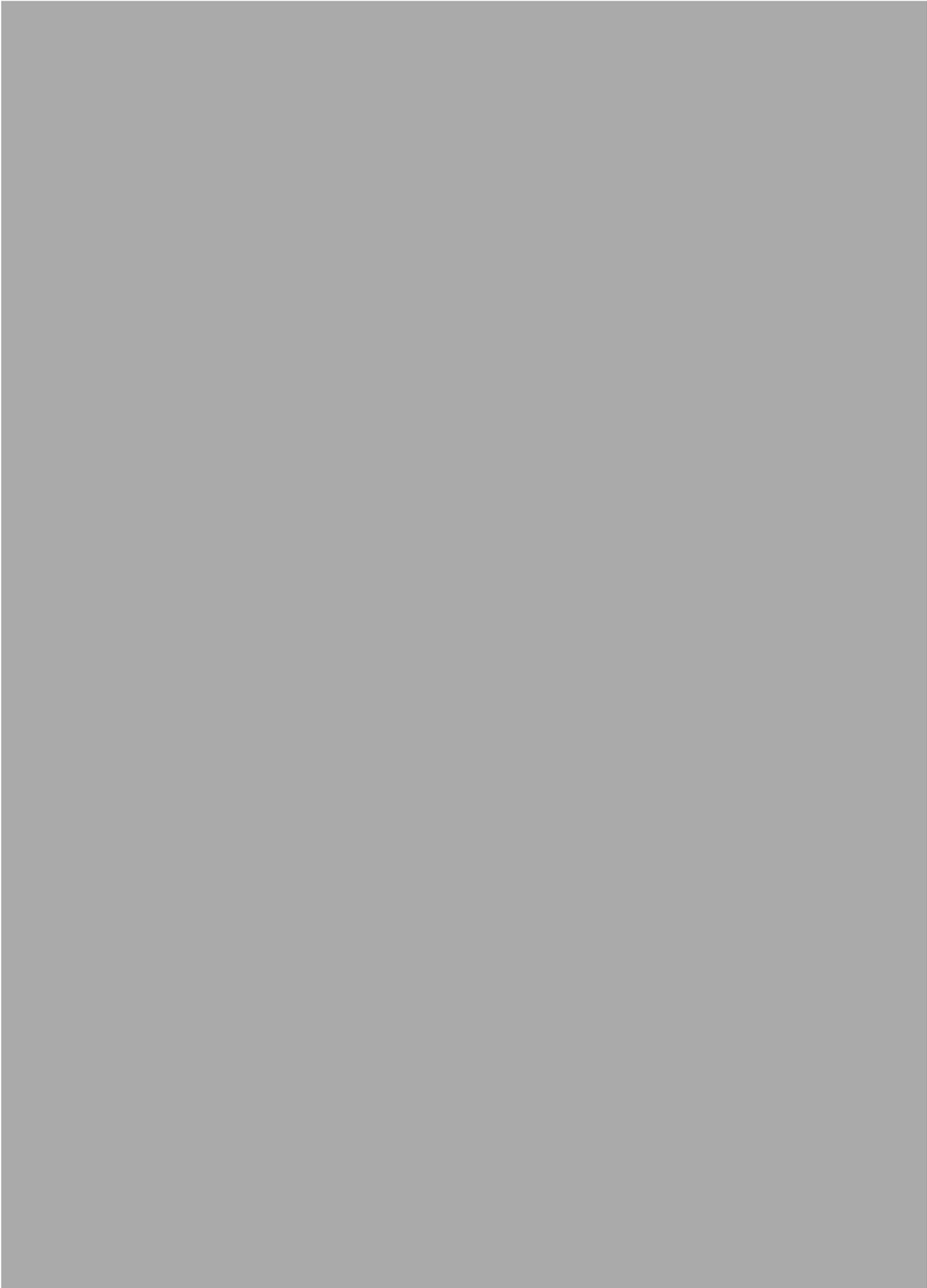
Zürcher, N.R., Donnelly, N., Rogier, O., Russo, B., Hippolyte, L., Hadwin, J., Lemonnier, E. & Hadjikhani, N. 2013, "Its All in the Eyes: Subcortical and Cortical Activation during Grotesqueness Perception in Autism: e54313", *PLoS One*, vol. 8, no. 1.

## **Appendix**

### **A1**

#### **A1.1 Application for Ethical Review ERN\_13-0832**





## A1.2 Example covering letter to parents

### **An invitation for your child to take part in a research study exploring how pupils draw faces**

**Dear Parent(s)/Guardian,**

I would like to recruit a small sample of pupils from your child's school to take part in a study towards my MPhil degree at the University of Birmingham.

This would involve a thirty-minute session during the spring term, where your child would be asked to draw a number of faces. The research period will be from January up to the end of April 2013.

Attached is an information sheet giving more details and a consent form for you and your child to sign. I would be very grateful if you could read the information sheet and consent form carefully and if you are happy for your child to take part then please return the signed consent form to the school.

If I do not hear from you, I will assume that you do not want your child to take part in the study. If you have any questions then, please email me at the address below or contact the school for more details.

Yours Sincerely

Ceri Edwards

Email : 

University of Birmingham  
Ceri Edwards

Version 2, 6/11/13

## **Information Sheet for Pupils (A)**

### **An exploration of how pupils draw faces**

#### **Invitation to take part in a research project**

You are being invited to take part in a research study that wants to find out more about how typical pupils and pupils with autism process visual information, in particular how they draw a face. This information sheet will explain why this research study is being done and how you can be involved. If you agree to take part, it is important that you read this information carefully and ask any questions that you need to, before you decide whether or not you would like to take part.

#### **What is the purpose of this research?**

There are many ways to consider an image of a face and the body. Pupils with autism often do not look at people's faces as much as, or in the same way, as typical pupils. This may be reflected in their drawing of the face. This small study seeks to explore whether this is the case.

#### **Why have you been chosen?**

You have been chosen because I understand that you have received a diagnosis of autism or Asperger's syndrome and you are aged between 12 and 16 years.

#### **What will you be asked to do if you choose to take part?**

You will be asked to draw faces from five different sources, with breaks in between if you need them. You will draw

1. A face from memory
2. A face of a cartoon character
3. A face from a photograph
4. The face of an adult
5. A self portrait of your own face using a mirror

A video recording will be made to capture how you work on each drawing. The camera will be behind you and focused on the paper. Please do not worry about how well you are able to draw as this study is not about the quality of your drawings.

You will have an individual session as part of the school day. The school staff will arrange with you the most appropriate time to do the drawing which will take about 30 minutes.

#### **What are the possible benefits of taking part?**

Taking part in this research will give you an opportunity to share your experience and a short document on the results of the study will be available for you at the end of the study.

**Do you have to take part?**

No. You do not have to take part in the research.

**What are the possible risks in taking part**

There is no foreseeable risk in taking part in this research study.

**Confidentiality**

If you agree to take part in this research study you will be asked to sign a consent form, giving the researcher permission to include what you say as well as observations made during the research. The notes will be kept anonymous and confidential so that you cannot be identified. The information can only be accessed by the researcher, Mr Ceri Edwards.

**Dissemination**

The research may be published in a journal or a website but no names of pupils will be given. The findings from the data will be amalgamated and generalised into themes and any identifiable information or drawings will be removed. Therefore it will not be possible to identify individual participants artwork. Once the research has been completed and submitted to the University the data will be preserved and accessible for up to ten years

**Deciding whether to participate**

If you would like to ask more questions before deciding, please contact Ceri Edwards. If you choose to withdraw your consent during the research, which will end in April 2014. The data will be destroyed and no further information will be collated. You are free to change your mind at any time up to the end of the research period without giving a reason.

Please contact Ceri Edwards on

## **Information Sheet for Parents (B)**

### **An exploration of how pupils draw faces**

#### **Invitation to take part in a research project**

Your child is being invited to take part in a research study to explore how typical pupils and pupils with autism process visual information, in particular how they draw a face. Your child would be in the typical pupil group. This information sheet will explain why this research study is being done and how your child can be involved. If your child agrees to take part, it is important that they read the information carefully and asks questions, if necessary, before deciding whether or not to take part.

#### **What is the purpose of this research?**

There are many ways to consider an image of a face and the body. Pupils with autism often do not look at people's faces as much as, or in the same way, as typical pupils. This may be reflected in their drawing of the face. This small study seeks to explore whether this is the case.

#### **Why has your child been chosen?**

Your child has been chosen because they attend a mainstream secondary school and are aged between 12 and 16 years.

#### **What will your child be asked to do if they choose to take part?**

Your child will be asked to draw faces from five different sources, with breaks in between if needed, as follows:

1. A face from memory
2. A face of a cartoon character
3. A face from a photograph
4. The face of an adult (the researcher)
5. A self portrait of their own face using a mirror

A video recording will be made to capture how your child works on each drawing. The camera will be behind the child and focused on the paper. Please do not worry about how well your child is able to draw as this study is not about the quality of their drawings.

Each pupil will have an individual session as part of the school day. The school staff will arrange with your child the most appropriate time to do the drawing which will take about 30 minutes.

#### **What are the possible benefits of taking part?**

Taking part in this research will give your child an opportunity to share their experience and a short document on the results of the study will be available for them at the end of the study.

**Do they have to take part?**

No. They do not have to take part in the research.

**What are the possible risks in taking part**

There is no foreseeable risk in taking part in this research study.

**Confidentiality**

If your child agrees to take part in this research study, they will be asked to sign a consent form, giving the researcher permission to include the comments they make and the drawings made during the research in the thesis. The person supporting them to make sure that they have understood and are able to give their consent will also sign the consent form. Each pupil will have an individual session and therefore will not know when other pupils have taken part in the study. The notes will be kept anonymous and confidential so that they cannot be identified. The information can only be accessed by the researcher, Mr Ceri Edwards.

**Dissemination**

The research may be published in a journal or a website but no names of pupils will be given. The findings from the data will be amalgamated and generalised into themes and any identifiable information or drawings will be removed. Therefore it will not be possible to identify individual participants artwork. Once the research has been completed and submitted to the University the data will be preserved and accessible for up to ten years

**Deciding whether to participate**

If you would like to ask more questions before deciding, please contact Ceri Edwards. You can choose to withdraw at any point during the research, which will end in April 2014. The data will be destroyed and no further information will be collated. You are free to change your mind at any time up to the end of the research period without giving a reason.

Please contact Ceri Edwards on 

## **Information Sheet for Head Teachers (A)**

### **An exploration of how pupils draw faces**

#### **Invitation to take part in a research project**

I would like to invite 8 typical pupils and 8 pupils with autism or Asperger Syndrome to take part in a research study that wants to find out more about how typical pupils and pupils with autism process visual information, in particular how they draw a face. This information sheet will explain why this research is being done and how your pupils can be involved. If they agree to take part, it is important that they read the information carefully and ask any questions that they need to, before they decide whether or not they would like to take part.

#### **What is the purpose of this research?**

There are many ways to consider an image of a face and the body. Pupils with autism often do not look at people's faces as much as, or in the same way, as typical pupils. This may be reflected in their drawing of the face. This small study seeks to explore whether this is the case.

#### **Why have your pupils been chosen?**

They have been chosen because they have a diagnosis of autism or Asperger Syndrome and are aged between 12 and 16 years.

#### **What will they be asked to do if they choose to take part?**

Each pupil will be asked to draw faces from five different sources, with breaks in between if they need them. They will be given up to five minutes to draw each of the following:

1. A face from memory
2. A face of a cartoon character
3. A face from a photograph
4. The face of an adult
5. A self portrait of their own face using a mirror

They will do this on their own with a member of staff and the researcher present. A video recording will be made to capture how they work on each drawing. The camera will be behind them and focused on the paper. It does not matter how well the pupils are able to draw as this is not a study about the quality of their drawings.

Each pupil will have an individual session as part of the school day. Your staff will be asked to find the most appropriate time for each pupil to take part in this research study which will take about 30 minutes.

#### **What are the possible benefits of taking part?**

Taking part in this research will give them an opportunity to share their experience and a short document on the results of the study will be available for them at the end of the study.

**Do they have to take part?**

No. They do not have to take part in the research.

**What are the possible risks in taking part**

There is no foreseeable risk in taking part in this research study.

**Confidentiality**

If they agree to take part in this research study they will be asked to sign a consent form, giving the researcher permission to make a video recording of their drawings and any comments made during the research. The person supporting them to make sure that they have understood and are able to give their consent will also sign the consent form. The video recordings notes and video clips used will be kept anonymous and confidential so that they cannot be identified during publication or presentations. The information can only be accessed by the researcher, Mr Ceri Edwards. Each pupil will have an individual session and therefore will not know when other pupils have taken part in the study.

**Dissemination**

The research may be published in a journal or a website but no names of pupils will be given. The findings from the data will be amalgamated and generalised into themes and any identifiable information or drawings will be removed. Therefore it will not be possible to identify individual participants artwork. Once the research has been completed and submitted to the University the data will be preserved and accessible for up to ten years

**Deciding whether to participate**

The pupils and their parents will be asked to read the information sheet and sign a consent form. If the pupils would like to ask more questions before deciding, please contact Ceri Edwards. If they choose to withdraw their consent during the research , which will end in April 2014, the data will be destroyed and no further information will be collated. They are free to change their mind at any time up to the end of the research period without giving a reason.

**What do you need to do?**

I would be grateful if you could assist with the identification of suitable pupils to recruit to the study and if you or your staff could give out the participant information sheets and consent forms to the parents and pupils.

Please contact Ceri Edwards on 

A1.6 Example consent form

## Parent and Pupil Consent Form

### An exploration of how pupils draw faces

**Name of Researcher:** Mr. Ceri Edwards

Note to parents – Please read the information sheet and if you are willing for your child to take part, please discuss this with them. If you both agree, then please complete and return this form.

Please tick

We confirm that we have read and understand the information sheet for the study and have had the opportunity to ask questions.

We understand that our participation is voluntary and that we are free to withdraw at any time, without having to give a reason.

We understand that any personal information provided to the researcher will be kept strictly confidential.

We agree that the researcher can use information collected on the drawings in their thesis and we understand that any publications and references will be anonymous.

We agree to take part in the above study.

-----  
Name of pupil

-----  
Date

-----  
Signature

-----  
Name of parent

-----  
Date

-----  
Signature

-----  
Name of Researcher

-----  
Date

-----  
Signature

University of Birmingham  
Ceri Edwards

Version 2, 6/11/13

## **A2.1 Responses from follow up questions asked**

### **Group A participant 1**

Q1 – When drawing a face are there any areas that you consider more important the image than others?

A- eyes eye brows shape of face hairstyle and chin.

Q2- second question; when drawing faces are there any particular details that you spend more time and effort depicting?

A- the position of the nose, eyes and their were abouts on the head.

### **participant 2**

Q1 – When drawing a face are there any areas that you consider more important the image than others?

A-I think it's the whole face really, the outside.

Q2- second question; when drawing faces are there any particular details that you spend more time and effort depicting?

A- well if a lights on them you might have to look about where there shadow is. If your like drawing the whole of them. So if there, if there face is the shadow and its coming onto the table then you draw all of it.

### **participant 3**

Q1 – When drawing a face are there any areas that you consider more important the image than others?

A- mouth. And eyes.

Q2- second question; when drawing faces are there any particular details that you spend more time and effort depicting?

A- I think more eyes and hair.

Continuation from questions;

Researcher- so tell me again what you where saying.

Student- I was saying how I wouldn't.... I would look at the out line because every one has a different shape of head. And err it would be easier for me to distinguish between people if they where facing away from me because if I'm looking at some ones face, then it would.... I wouldn't be able to see the back... if I weren't looking at the back of the head I wouldn't know who they were. So it's easier to see from the back.

#### **participant 4**

Q1 – so the first question; when drawing a face are there any areas that you consider more important the image than others?

A- what is it?

Q1- like so when you draw a face are there any bits that you think are more important? Like what are the things that you notice first?

A- the first picture was of my brother. I didn't .....

Researcher- so when you remembered your brother what part of his face did you think for first?

A- errrrm I don't know?

Researcher- so for example was it the shape I'm or eyes. or...

A- eyes....

Q2- last question; are there any bits that you spend more time drawing?

A- sometimes the eyes? And the head.

#### **participant 5**

Q1 – first question. When drawing a face are there any areas that you consider more important the image than others?

A- I don't know. No

Researcher- none at all?

Q2- second question; when drawing faces are there any particular details that you spend more time on?

A-eyes

#### **participant 6**

Q1 – first question. When drawing a face are there any areas that you consider more important the image than others?

A- errrm head shape.

Q2- cool right next question; when drawing faces are there any particular details that you spend more time and effort depicting?

A- Head shape.

### **participant 7**

Q1 – first question. When drawing a face are there any areas that you consider more important the image than others?

A- the hair

Q2- cool right next question; when drawing faces are there any particular details that you spend more time and effort depicting? So you spend more time on them.

A- I think the eyes and for example because they show more emotion.

### **Group B (TD)**

#### **participant 1**

Q1 – When drawing a face are there any areas that you consider more important the image than others?

A- erm the eyes.

Q2- second question; when drawing faces are there any particular details that you spend more time and effort depicting?

A- the lips

#### **participant 2**

Q1 – When drawing a face are there any areas that you consider more important the image than others?

A- the eyes

Q2- second question; when drawing faces are there any particular details that you spend more time and effort depicting?

A- hair

#### **participant 3**

Q1 – When drawing a face are there any areas that you consider more important the image than others?

A- hmmm I have no idea.

Researcher- what was it you talked about a second ago?

A- eyes

Q2- second question; when drawing faces are there any particular details that you spend more time and effort depicting?

A- hair.

#### **participant 4**

Q1 – When drawing a face are there any areas that you consider more important the image than others?

A- erm the little bits because you have to make them more effective.

Q2- second question; when drawing faces are there any particular details that you spend more time and effort depicting?

A-no

Researcher- none?

A- no

#### **participant 5**

Q1 – When drawing a face are there any areas that you consider more important the image than others?

A- probably the eyes nose and mouth.

Q2- second question; when drawing faces are there any particular details that you spend more time and effort depicting?

A- hair and mouth. Have to get there position right.

#### **participant 6**

Q1 – When drawing a face are there any areas that you consider more important the image than others?

A- errrm the eyes

Q2- second question; when drawing faces are there any particular details that you spend more time and effort depicting?

A- errm not really. It depends on the amount of time you have to spend, I think

**participant 7**

Q1 – When drawing a face are there any areas that you consider more important the image than others?

A- I think eyes, nose and mouth. And basic facile features are more important than stuff like face structure and hair. Because they're more identifiable. Erm but also eye shape as they can vary allot but also nose shape and whether it's big round or small.

Q2- all right, second question; when drawing faces are there any particular details that you spend more time and effort depicting?

A- probably eyes errm nose depending on the facile structure if they have very bold cheek bones errm probably mouth as well.... Yea.