University of Glasgow
School of Education

University of Glasgow School of Psychology

ID NUMBER:

DATE: 12.08.2019

WORD COUNT: 9565

SUPERVISOR: Dr. Joanna Wincenciak

MSc Psychological Studies
Dissertation 2018-19
Delivered jointly:

Education (EDUC5839) and
Psychology (PSYCH5040)

Cooperation and trustworthiness perception in children

Declaration: I have read and understand the University of Glasgow guidelines on plagiarism (found in the MSc Psychological Studies handbook) and declare that this piece of work is entirely my own work. All sources have been acknowledged in the text and included in the reference section. All quotations from other authors are marked as such in the text

I have submitted to Urkund an electronic copy of this coursework that matches exactly this hard copy submission; and have read through the University of Glasgow's declaration of originality, located here:
https://www.gla.ac.uk/media/media_100977_en.docx

I realise that I ticked my acceptance of the above declaration on Urkund during the electronic submission.

[x]

Please tick here that the above statement is true

NB. Almost all work, wherever practical, is anonymously marked, so please do not sign the declaration.

Table of Contents

Abstract

Background: Humans possess a tendency to make spontaneous and consistent evaluations of unfamiliar faces which impact their social decision-making process. A wealth of research shows that this tendency emerges early on in childhood. It has been indicated that several developmental changes occur in a child's ability to make trustworthiness judgements that are environmental in nature. Moreover, it has also been determined that trustworthiness judgements are influenced by contextual information, such as brief social interactions and previous knowledge through meeting. Consistently, the current study predicted that cooperation will influence children's trustworthiness judgements, as it increases pro-social behaviour amongst children. Therefore, this study aimed to investigate three main hypotheses: 1) Increase in cooperative behaviour will enhance the accuracy of trustworthiness judgements in children, 2) Younger children will make poorer trust judgements compared to Older children, and 3) Children will invest more with trustworthy-looking faces than untrustworthy-looking faces.

Methods: The participants were recruited at the Glasgow Science Centre. They were divided into two conditions; cooperation condition, where they were encouraged to play with LEGO Duplo blocks in groups and the individualistic condition, where they played with LEGO Duplo blocks individually. The participants were engaged in two tasks. In the trust perception task participants indicated which face they find more trustworthy. Whilst in the trust investment task they indicated their willingness to trust each of the faces. According to the second hypothesis, participants were divided into categories of younger (below the age of 7) and older (age 7 and above) children. The data was analysed on R studio and for hypothesis testing, two-way and mixed ANOVA was applied.

Results: Findings show that there is no significant difference between the trust accuracy of children with or without cooperation priming. Moreover, there was no significant difference between children's trust investment in cooperation condition and individualistic condition. Secondly, results indicated no significant difference between the trust judgements (trust and accuracy and trust investment) of younger and older children. Additionally, it was revealed that younger children invest more than older children. Lastly, all the participants invested more with untrustworthy-looking faces rather than trustworthy-looking faces.

Conclusions: Further research is required to validate that there is no difference in trust judgements after engaging in cooperative activities. Results contradict previous research suggesting that there is no difference in the trust perception of younger and older children. However, the results of the trust investment task are in line with previous findings, suggesting that there is no significant difference in the trust investment of younger and older children. Finally, results contradict previous findings indicating that children invest more with untrustworthy faces than trustworthy faces.

Keywords: trustworthiness judgement, cooperation, children, pro-social behaviour, facial appearance.

Introduction

In an initial face-to-face interaction, one's physical appearance is the first piece of information available to the perceiver and it can significantly influence their subsequent behaviour. Human faces convey a large amount of information, such as gender, emotion, people's identity and direction of attention that help us make social decisions (Zebrowitz & Montepare, 2005). Complex personality traits, such as extraversion (Naumann, Vazire, Rentfrow & Gosling, 2009), leadership qualities (Re & Perrett, 2014), competence (Ballew & Todorov, 2007) and trustworthiness (Strange, Winston, O'Doherty & Dolan, 2002; Caulfield, Bank & Rhodes, 2016) are also judged based on one's facial appearance. One of the most commonly made social decisions derived from facial features is the judgment of trustworthiness.

Interpersonal trust

Trust is crucial for interpersonal and commercial relationships. It is important for initiating and maintaining successful social relationships and accurate trustworthiness judgments are essential for social functioning. Rotenberg's (1994, 2001) model of trust postulates that interpersonal trustworthiness relies on three key elements; honesty (telling the truth and engaging in behaviour guided by genuine intent), reliability (fulfillment of promise) and emotional trust (relying on others emotionally such that they maintain confidentiality). Oosterhof & Todorov (2008) developed a 2D model of face evaluation and identified two key components that humans focus on while making instantaneous judgments based on facial properties; Valence (whether to approach or avoid the person) and Dominance (the physical strength of the person). Crucially, these dimensions can be reliably estimated by judgements of trustworthiness and dominance. In other words, judgments are made after determining the intention of a person and measuring their ability to implement that intention. A quick

evaluation of trustworthiness of faces is essential because it can guide us whether to initiate and maintain a relationship, thereby helping us regulate our attention and response towards the incoming stimuli (Vuilleumier, Armony, Driver & Dolan, 2001).

Trustworthiness judgement derived from faces

Typically we make judgements about a person's trustworthiness after repeated interactions, based on four key elements; ability (if the person is capable), benevolence (if the person is nice), honesty (if the person is truthful), and reliability (if the person is reliable) (Mayer, Davis & Schoorman, 1995). Due to lack of sufficient time and information to make informed judgments adults often use 'shortcuts' to make evaluative judgments in a given context, such as while making electoral decisions voters focus on the competence dimension and believe it is the most important aspect of a politician (Todorov, Mandisodza, Goren & Hall, 2005). Similarly, while making mating decisions physical attractiveness prevails over other dimensions, including trustworthiness. Judging trustworthiness is related to categorization into 'good guy/bad guy' (Todorov, 2008), whereas perceived attractiveness changes one's behaviour towards other people. For example, attractive people are more likely to receive favourable treatment and higher salaries compared to people who are perceived to be less attractive (Langlois, Kalakanis, Rubenstein, Larson, Hallam & Smoot, 2000). Research shows that there is a positive correlation between trustworthiness judgments and attractiveness judgments, the more attractive the faces are perceived to be, the higher trustworthiness ratings they receive (Schmidt, Levenstein & Ambadar, 2012; Scharlemann, Eckel, Kacelnik & Wilson, 2001). Moreover, a high correlation between participants' judgments of trustworthiness and facial features, such as brow ridge (down or up), cheekbones (shallow or pronounce), chin (wide or thin) and nose sellion (shallow or deep) were found (Todorov, Baron & Oosterhof, 2008). Interestingly, research shows that adults can make judgments regardless of being exposed to an entire face, indicating that evaluations

can be made just by viewing the eyes and the mouth region (Rojas, Masip, Todorov & Vitria, 2011).

Although trust is a key component in our social lives, sometimes it is difficult to judge whom to trust. Nonetheless, we humans make trust judgments often easily and quickly. Research suggests that trait judgments are made after very brief exposure to faces, roughly 100ms seems to be enough to make strong judgments and about 500ms to have full confidence in the judgments made previously (Willis & Todorov, 2006). It appears that In fact, as little as 33-38ms seems to be sufficient for observes to start discriminating between different categories of faces (Bar, Neta & Linz, 2006). According to the Dual-process theory by David Kahneman, making trust judgments can be categorized as a "System 1" process which is fast, effortless and intuitive compared to "System 2" processes that are effortful, slow and more likely to be consciously monitored (Kahneman, 2003). Together this implies that adults make judgments about personality automatically with no intention and deliberation of making them. Walter Cannon's fight-or-flight response theory (also known as acute stress response) suggests that "an animal reacts to threat with a general discharge of the sympathetic nervous system, preparing the animal for fighting or fleeing" (Arthur, Nguyen, Karpitskiy, Mettenleiter & Loewy, 1995). So, an evolutionary perspective is that through natural selection humans have evolved to use the fight-or-flight response when faced with a threatening stimulus which helps them to make quick, uncalculated decisions (Nesse, Bhatnagar & Ellis, 2016).

Trustworthiness judgments are, however, influenced by variety of factors, such as brief social interactions (Frank, Gilovich & Regan, 1993), information available about their character (Delgado, Frank & Phelps, 2005), previous knowledge of the person through meeting (Vanderbilt, Liu & Heyman, 2011), and simply viewing their faces (Strange et al, 2002). There are individual differences in how we make trust judgements. For instance, in a

recent study, it was demonstrated that female observers show adaptation aftereffects to trustworthy and untrustworthy faces whilst male observes remain uninfluenced (Wincenciak, Dzhelyova, Perrett & Barraclough, 2013). Interestingly, not only does the gender of the observer cause bias in perception but the gender of the stimuli also influence observer's judgement. Dzhelyova, Perrett & Jentzsch (2011;2012;) confirmed that a gender bias prevails amongst observers as they tend to perceive female faces to be more trustworthy compared to male faces. Moreover, contextual information can influence the perceivers' trust judgements. Research shows that experiencing social stress (Toet, Bijlsma & Brouwer, 2017) and anxiety (Attwood, Easey, Dalili, Skinner, Woods, Crick, Munafò, 2017) before the judgement making process has an impact on the trustworthiness ratings of the facial stimuli. Further, the type of faces (e.g. attractive faces, older faces, masculine faces) individuals are adapted to throughout their lifetime also indicates the extent to which they find a particular face trustworthy (Buckingham, DeBruine, Little, Welling, Conway, Tiddeman & Jones, 2006). This implies that although trust judgements are made automatically, they may also be sensitive to internal and external factors.

Also, developmental disorders indicate variations in trustworthiness judgments, for example, individuals with Autism Spectrum Disorder (ASD) are less likely to get influenced by facial cues compared to typical individuals (Hooper, Sutherland, Ewing, Langdon, Caruana, Connaughton & Rhodes, 2018). However, elaborate literature suggests that the face-based trust judgments made by adults are high in agreement (Oosterhof & Todorov, 2008; Todorov, Baron & Oosterhof, 2008). This agreement has also shown to occur among individuals who judge unfamiliar faces from unfamiliar races (Xu, Wu, Toriyama, Ma, Itakura & Lee, 2012; Birkás, Dzhelyova, Lábadi, Bereczkei & Perrett, 2014).

Additionally, adults make accurate judgments of trustworthiness through facial cues (Verosky, Porter, Martinez & Todorov, 2018) and they rely on these judgments to make

adaptive decisions. However, there is no concluding evidence to show that people with a more trustworthy face also behave in a more trustworthy manner (Rule, Krendl, Ivcevic & Ambady, 2013). Regardless of the validity of the judgments that are made based on crude facial information, they have a significant impact on our social decisions in daily life. For example, when the host's profile photos are perceived to be more trustworthy, they receive higher Airbnb bookings regardless of valid information available on the reviews (Ert, Fleischer & Magen, 2016). Similarly, during economic interactions, such as trust games (Berg, Dickhaut & McCabe, 1995) participants make larger investments if they perceive the faces to look more trustworthy compared to when they perceive the faces to look untrustworthy irrespective of accurate knowledge of the trustee's personality (Chang, Doll, van 't Wout, Frank & Sanfey, 2010). The trust games are an effective and elegant way to determine the influence of various facial cues on the judgment of trust behaviour.

Neural mechanisms of face evaluation

While behavioral research signals the impact of facial appearance on trait judgments (Zebrowitz, 2018), cognitive neuroscience research has directed focus to investigate the neural mechanisms underlying these judgments. fMRI studies indicate that there is increased activity in the right amygdala (a subcortical region in the brain responsible for making 'fight-or-flight' decisions) when one views a more untrustworthy face (Strange et al, 2002; Engell, Haxby & Todorov, 2007). Interestingly, research shows that subjects with a basolateral amygdala (BLA) damage show more generosity in economic games, which indicates that during a trust game they tend to invest more on untrustworthy faces despite having full knowledge of the social world and having similar trustworthiness ratings to the non-damaged subjects (Honk, Eisenegger, Terburg, Stein & Morgan, 2013). This literature extends the evidence regarding the automaticity of trait judgements. From a neurological

perspective, social judgements made are a combination of several factors, such as brain activation and information processing.

Developmental trajectory of trust perception

While extant research suggests that adults have evolved to be complex decoders of trust information based on facial features, considerable research has also investigated the development of this ability in children. For example, in a recent study, Cogsdill, Todorov, Spelke & Banaji (2014) found that children as young as 3 years old show adultlike tendency to attribute trustworthiness by distinguishing between 'nice' and 'mean' faces. Whereas, Ewing, Caulfield, Read & Rhodes (2015) found that the ability to discriminate faces among trustworthiness dimension may not emerge until the age of 5. Moreover, children modulate their trust judgements based on emotion cues (Caulfield, Bank & Rhodes, 2016). Although there is contradicting evidence regarding the age at which children develop the ability to form trust judgments, there is consistent evidence suggesting that children exhibit clear preference among attractive and unattractive faces from a very early age (Quinn, Kelly, Lee, Pascalis & Slater, 2008). Like adults, children perceive attractive faces to be more trustworthy (Cogsdill & Banaji, 2015). Interestingly, the within-group agreement is higher for attractive faces unlike for trustworthy faces. However, research shows that the level of agreement increases with age (Cogsdill et al, 2014).

Trust plays a crucial role in children's development and psychosocial functioning (Erikson, 1963). The ability to judge trustworthiness based on non-verbal cues during initial interactions is vital for healthy wellbeing, self-protection and social adjustment (Rotenberg, Boulton & Fox, 2005). Research suggests that typical children extract information from facial cues and use such information to make informed decisions from a very early age (Verosky et al, 2018). It is important to note that trust is viewed as a crucial

attribute of a close relationship competence (Larson, Whitton, Hauser & Allen, 2007). A wealth of research has evidenced the downsides of having a lower sense of trust. Rotenberg, Addis, Betts, Corrigan, Fox, Hobson & Boulton (2010) suggest that lower trust beliefs are associated with increased loneliness among children and adolescents. The negative association between trust and loneliness was proposed because children who have lower trust beliefs tend to be unreliable, dishonest and are unable to initiate social interactions which leave them feeling that they do not belong to a social group. Moreover, Goddard (2003) suggested that high levels of trust are associated with higher student success because students are more likely to openly exchange information with their peers when they have a high sense of trust. It results in increased social engagement and engagement with teachers motivate students to work harder and understand the subject matter better.

Given the crucial role of trust perception in children, understanding the development of the sense of trust becomes important. Research suggests that the development of a sense of trust in children is largely environmental rather than genetic (Sakai, 2010). Vanderbilt et al (2011) found that children under the age of 4 years have difficulty in discriminating between trustworthy and untrustworthy behaviour (i.e. helpers or trickers) but school-aged children (5 years and above) develop the ability to discriminate trust and are more likely to trust individuals who have previously helped them. This indicates that middle-aged children do not trust people indiscriminately unlike pre-school children (Harris & Corriveau, 2011). Several plausible explanations have been proposed to explain the developmental change in children's ability to make trust decisions. A sense of trust develops in the context of a secure environment through the family. From the perspective of attachment style theorists, trust is a key component to establish a secure attachment with the parents or caregiver. Consistently, Lieberman (2003) argued the importance of early caregiving environments. Maltreatment during childhood and an insecure attachment style

with the caregiver leads to an irrational sense of trust during the child's development. Such children tend to become indiscriminately friendly (Rutter, Kreppner & Sonuga-Barke, 2009), showing higher orientation towards adults, not being selective while making friends and communicating with strangers (Hodges & Tizard, 1989). Through a qualitative study, Bennett, Espie, Duncan & Minnis (2009) demonstrated that despite being aware of the risks associated with talking to strangers a group of young, maltreated children projected indiscriminate trust in new people and craved kindness from others. Miellet, Caldara, Gillberg, Raju & Minnis (2014) suggested that such behaviour occurs as a result from a problem with processing visual and social information available for social judgment, which causes children with reactive attachment disorder (RAD) to make differed trust judgements compared to typically developing children who perform similar to adults. In summary, research suggests that lack of emotionally supportive caregivers during early life can lead the child to make inaccurate trustworthiness judgments.

Through stages of development, the notion of trust extends outside of the family and guides the child to trust his peers, teachers, and friends. As the child advances from infancy to early childhood, he gains experience by viewing several faces that provide an opportunity to make enhanced judgments. There is increased independent participation in social interactions as they enter school. Therefore, age-related experience has an impact on the nature of their judgments. Cooper, Geldart, Mondloch & Maurer (2006) conducted a detailed experiment to test this hypothesis. They poised that infants have an experience of viewing the high features of a face (chin area accentuated compared to the other features of the face) due to their perspective being distorted as they look up at the adult to view their face. Through development when the infants enter preschool years and puberty, their experience of viewing faces increase due to two reasons; the type of faces they view is not restricted their inner circle of caregivers which indicates that they view faces of their peers,

friends, and teachers and they view adult faces from an eye-level which promotes their judgment.

In addition, the face perception ability also increases with age because more attention to detail is paid as children grow up. To recognize a facial identity and its emotional expression, it is vital to be sensitive to second-order relations (e.g. distance between eyes, nose or individual structures of the face) (Mondloch, Geldart, Maurer & Grand, 2003). However, research shows that during early years children's ability is limited to processing first-order relations (features that are common in everyone, such as two eyes between the nose above the lips). Such lack of ability has been associated with underdeveloped cognitive abilities, such as the ability to maintain concentration, utilize memory strategies and to respond quickly, at least until the age of 6 years (Gilchrist & McKone, 2003 and Mondloch, Maurer & Ahola, 2006). Therefore, the maturity of the visual and cognitive systems may contribute to the differences in social judgements between children and adults.

Furthermore, fMRI studies have shown that the amygdala and the fusiform face area respond comparatively lesser until the age of 10 years (Aylward, Park, Field, Parsons, Richards, Cramer & Meltzoff, 2005). This indicates that the overall development of neurological and cognitive abilities play an important role in the accuracy of judgments made by children (Mondloch, Le Grand & Maurer, 2009). Keeping in mind the developmental changes, developmental disorders such as ASD can have a considerate impact on face processing and judgment making ability. Ewing, Caulfield, Read & Rhodes (2015) demonstrated that although atypical children make accurate trust judgments, there is a selective failure in using these judgments to guide their behaviour. In a recent study conducted by Hooper et al (2018) they laid out various explanations to justify such differences, such as social processing difficulties and substantial attention to detail may cause difficulties in making spontaneous decisions. All the evidence presented above suggest, there

may exist significant individual differences in the way faces are processed and judgments are made during early childhood.

Cooperation

Cooperation or the ability to coordinate one's action to achieve a shared goal is essential among all social beings for survival and maintenance of relationships. It is developed throughout childhood, through explicit learning and social experience. Cooperating with others to achieve a goal is a flexible behaviour in children that becomes increasingly complex and selective with age (Slocombe & Seed, 2019). Much of the early cooperative experiences come from interaction with siblings and peers. According to the social learning theory (Bandura & Walters, 1977) when children watch their parents work together in a supportive manner, they may adopt such positive behaviours and apply it in their peer interactions. Olson & Spelke (2008) found that there are three main principles of cooperation in children, they are, preferential sharing, direct reciprocity, and indirect reciprocity. Dolšak & Hillyard (2016) investigated that creative learning enhances cooperation. Co-operative behaviour has been found to depend on factors such as group size (Alencar, de Oliveira Siqueira & Yamamoto, 2008) and emotions (Gennari, Melonio, Raccanello, Brondino, Dodero, Pasini & Torello, 2017). However, cooperation requires a complex understanding of various courses of action and their interdependence to achieve a shared goal (Dunfield, Kuhlmeier, O'Connell & Kelley, 2011).

Development of cooperative behaviour

A wealth of existing literature has attempted to explain the development of the ability to cooperate in children. Infants attempt to collaborate through gestures before they speak (Tomasello, 2007) and by their second birthday children project prosocial behaviours (Warneken, Chen & Tomasello, 2006). However, social cognition is found to develop at an

age as early as 16 months in infants (Rhodes, Hetherington, Brink & Wellman, 2015). Social competence is a core component of cooperation (Laible, Carlo, Murphy, Augustine & Roesch, 2014). As it increases with age, the assumption is that it is one of the reasons for an increase in cooperative behaviour through childhood (Rubin, Bukowski & Laursen, 2011). Davidov, Zahn-Waxler, Roth-Hanania & Knafo (2013) suggested that an increase in sympathy is also a central factor that results in increased cooperative behaviour. More importantly, trust is a vital determinant of cooperation (Jones & George, 1998). Trust refers to an expectation of one's ability and integrity. Depending on those expectations certain behaviours are contributed towards achieving a shared goal (Balliet & van Lange, 2013).

The European authorities have declared cooperation as one of the core competencies required by the citizens in order to face the challenges of a globalized world (Rychen & Salganik, 2002). Since cooperative behaviour is considered crucial for functioning, understanding the benefits of acquiring this ability becomes important. Research suggests that during problem-solving, cooperation contributes to the understanding of the problem and enhances the child's learning within the domain (Ramani & Brownell, 2014). Interacting with peers not only facilitates problem-solving but helps the children understand their peer's perspective thereby expanding their Theory of Mind (ToM) (Caballero, Sellabona, Serrano, Sánchez, Caño & Codony, 2013). Early developmental psychologists proposed various theories regarding the benefits of cooperative play. Vygotsky (1962; 1978) argued that interaction with advanced partners is important for developing cognitive skills through joint attention and joint intension (Moll & Tomasello, 2007). Similarly, Piaget (1932) argued that interacting with peers of similar abilities is important for developing cognitive skills and concepts through shared intention and knowledge. Research supports these theories. For example, Drouvelis, Metcalfe & Powdthavee (2010) suggested that cooperation leads to more prosocial behaviours and more positive emotional response.

Furthermore, increased cooperation has also shown increased meta-cognitive skills (Heydenberk & Heydenberk, 2005), math ability (Artut, 2009) and cognitive development (Ramani, 2006).

Present study

It is evident that cooperative behaviour in children tracks a certain level of emotional and cognitive development in them. Higher levels of cooperation indicate better decision making and logical thinking patterns. To my best knowledge, I believe that existing literature has not investigated if cooperation has an impact on trustworthiness discrimination. Although trustworthiness judgments are formed automatically, they are influenced by environmental factors and are sensitive to contextual information, such as emotional cues (e.g. Ewing et al, 2015), observed past behaviours (Vanderbilt et al, 2011), or environmental and life-history factors (e.g. Miellet et al, 2014) rather than pure biological factors. Also, it is established that trust is an important pre-requisite to promote cooperative behaviour. Therefore, after careful consideration of the above-discussed literature, in this study, I aim at investigating the following three hypotheses:

1) There will be a significant difference in children's trust accuracy and trust investment in faces following a cooperation priming task.
2) There will be a significant difference between the Younger children's trust accuracy and trust investment compared to Older children.
3) Children will invest more with trustworthy-looking faces compared to untrustworthy-looking faces.

Further research can investigate whether there exists a two-way relationship between cooperation and trust in different age groups, such as adolescents.

Methodology

Participants

Participants in the study were ninety-eight typically developing children who were recruited at the Glasgow Science Center during the 'Meet the Expert' event on 6-7th and 15-16th June 2019. Participants were self-identified from the general population or visitors to the museum on these days. The average age of the participants ranged from 4 to 12 years with a mean of 7.75 years and SD of 2.23; 61 girls and 34 boys completed the study. Inclusion criteria for participants were that they should be between the age of 4-12 years. Participants from different cultural backgrounds and ethnicities were invited to participate. As a token of participation, the participants were given stickers at the end of the experiment.

Materials

Stimuli

Face stimuli were obtained from the Chicago face database (version 2.0.3) (Ma, Correll, & Wittenbrink, 2015). Following preceding studies of facial judgements of trustworthiness in children (Miellet et al, 2014; Ewing et al, 2015; Ewing et al, 2015; Hooper et al, 2018) prototype-based image transformations were used to digitally manipulate trustworthiness of face images. First, a trustworthy and untrustworthy face prototype (average) was developed using established computer graphic methods previously used in face perception studies (Tiddeman, Burt & Perrett, 2001). These prototypes were manufactured using images of 20 trustworthy, Caucasian female adults and 20 untrustworthy, Caucasian female adults, respectively. These images were selected from the database where rating on trustworthiness was provided by a group of independent observers. The average trustworthiness ratings of the faces selected for the untrustworthy prototype was: 3.98, and

the average trustworthiness ratings of the faces selected for the trustworthy prototype was: 2.98. Faces were first delineated using PsychoMorph (Tiddeman, Burt & Perrett, 2001) where 186 points were fitted to the specific facial features (Benson & Perrett, 1991; Rowland & Perrett, 1995). Next, the trustworthy and the untrustworthy prototypes were created by averaging the selected faces. Six Caucasian female adults were randomly selected as test faces from the same database. I created two versions of each test face; one with increased trustworthiness and one with decreased trustworthiness. These two versions were created by either adding (to create a trustworthy version) or subtracting (to create the untrustworthy version) 50% of the linear difference in shape information between the trustworthy and untrustworthy prototypes, to individual face (following Wincenciak et al, 2013). All faces were then masked around the face to remove distinctive features, such as hair, clothing, and jewellery. Faces had a direct gaze, minimal makeup, front-facing, and they were emotionally neutral. Example stimuli are illustrated in Figure 1 and 2.

Figure 1. Trustworthy (left) and untrustworthy (right) prototypes.

Figure 2. Two versions of the same sample stimuli used in the experiment, one with increased trustworthiness (left) and one with decreased trustworthiness (right).

Design

In order to collect the quantitative data required to meet the research aims, a between-subjects design was adopted. A separate set of participants were gathered for cooperation task and individual task. The predictor variables included in the experiment were cooperation priming and age group (Independent variables). There were two outcome variables (Dependent variables) in this study: 1) trustworthiness perception and 2) proxy of trust. The first variable was measured through the first task where the participants were presented with 6 pairs of faces (each pair including a trustworthy and an untrustworthy face) in a pseudo-randomized order. They were asked to choose the face that they thought was more trustworthy. The second variable was measured through the second task where the trustworthy and untrustworthy version of faces were presented individually in random order. It was an investment game where the participants indicated the number of stickers (between

1-6) they would share with each person through which their investment intention was measured.

Procedure

Participants were randomly allocated to either the cooperative or individualistic condition.

Cooperation task: In this task, the participants were required to play with LEGO Duplo blocks. They were encouraged to build a LEGO tower along with fellow participants to promote social skills (Hu, Zheng & Lee, 2018; LeGoff, 2004). Social skills required for building strategies, such as sharing, turn-taking, making eye contact and following social rules promote cooperation. The participants were provided with different parts of a LEGO set and were asked to build the tower together. This task took no more than 5-10 minutes. After this period, they were invited to complete the trust perception task.

Individual task: Here the participants were first invited to complete the trust perception. Afterward this, they were offered to play with LEGO Duplo blocks without any directions directly from the experimenter. This is a control task crucial to examine if the results vary in the absence of cooperation priming.

Trust perception task: This was a computer-based face perception task. Twelve female faces (6 trustworthy and 6 untrustworthy faces) were digitally manipulated depicting high and low levels of trustworthiness. The participants were asked to indicate which face they find more trustworthy from the pair of faces presented to them. Next, the participants were asked to invest stickers in each of the trustworthy and untrustworthy female faces to measure their willingness to trust them (Ewing et al, 2015). The faces were presented in a pseudo-randomized order and remained indefinitely on the screen until the participants made a judgement. For the first task, participants had to make a two-alternative forced choice

(2AFC) between the trustworthy and the untrustworthy faces and for the second task, they rated their level of trust on a six-point scale (1 = *not at all trustworthy* to 6 = *extremely trustworthy*) using stickers. Faces were limited to a single ethnicity to avoid potential race effects on the facial projection of trustworthiness (Sutherland, Liu, Zhang, Chu, Oldmeadow & Young, 2018). Moreover, to avoid any gender effects on the impressions of trustworthiness, only female faces were chosen. The trust perception and trust investment tasks were carried out on two computers (1. MacBook Air, 13-inch screen, 2. MacBook Pro 17-inch screen). The experimenter first explained the meaning of interpersonal trustworthiness; that it is focused on three key elements; honesty, reliability and emotional trust (Rotenberg, 1994; Rotenberg, Fox, Green, Ruderman, Slater, Stevens & Carlo, 2005). Then, they were asked to choose which face they thought was more trustworthy from the 12 pairs of faces shown. After this, the participants were given 6 stickers. Then they were shown the digitally manipulated photos of female faces and were asked "How many stickers will you give to this person?". There was no use of deception in this experiment and the participants were debriefed thoroughly after the experiment. The study lasted approximately 10 minutes.

Ethical consideration

Since the study involves a vulnerable group of participants (ages below 18 years) an ethical approval from the Glasgow University Ethics Committee was obtained, to ensure complete risk management. All parent(s) or caretakers were present during the task and provided consent for the children to take part in the experiment. Consent from children was also obtained. Participants and the caretakers were informed that their anonymity will be maintained and that they are free to withdraw from the experiment at any point without providing a reason. Additionally, they were informed that they could choose to have their data removed even after the experiment had been completed. Lastly, they were informed that

they could contact Dr. Joanna Wincenciak (Joanna.Wincenciak@glasgow.ac.uk) for any further information. Informed consent from the Glasgow Science Center, to carry out research procedures was obtained prior to the experiment.

Data analysis

The primary data was obtained through two tasks; trust perception and trust investment task. Trust perception was calculated by adding the number of times the participants accurately chose the trustworthy faces from the pair of faces shown. Whereas, trust investment was calculated by finding an average of the proportion of stickers participants invested with each of the trustworthy-looking and untrustworthy-looking stimulus type. The personal data were de-identified and analyzed on R studio (1.1.463 version). Data from some participants were excluded due to reasons, such as participants quit the tasks mid-point and missing data due to an experimental error (see Results section, for further details). Therefore, through listwise deletion, the final participants' data in each of the two tasks was gathered. First, a Shapiro Wilk test was conducted to check for normality of data distribution. In the test, for a p-value greater than 0.05, data is considered to be normally distributed (Ruxton, Wilkinson & Neuhäuser, 2015). Next, a Welch t-test was used to calculate the mean age of the participants in the individualistic and cooperation condition as well as to identify at what age I could split the participants between Younger and Older children. I used a two-sided Welch t-test because it is a non-parametric measure and the age of the participants were not normally distributed (Lakens, 2015). Lastly, two-way and three-way Analysis of Variance (ANOVA) was conducted to analyse whether there were statistically significant main effects and interaction effects between the variables used in the study. ANOVA was used because it has been consistently researched to be a robust method to analyse data in the presence of unequal, non-normal data (Schmider, Ziegler, Danay, Beyer & Bühner, 2010).

Results

This experiment aimed to test whether engaging children in cooperative activity leads to higher levels of accuracy in trustworthiness judgements. The data was collected in two tasks; Trust Perception (Task 1) and Trust Investment (Task 2). Task 1 was adopted to measure the difference in mean trust accuracy between participants in the cooperation condition and the individualistic condition. Task 2 was designed to measure the children's willingness to invest resources (stickers) with either trustworthy-looking or untrustworthy-looking faces. The analysis of the data obtained is explained in detail below.

Data cleaning

Ninety-eight participants (see Methods section, for details) took part in the study. However, data from 22 participants were excluded from Task 1 and data from 31 participants were excluded from Task 2, as these participants failed to engage with the study task (e.g. pressed the same button throughout the experiment (N = 16), received help or instructions on how to respond from their parents (N = 1), did not complete the task and quit mid-point (N = 11) or there was missing data due to an experimental error (N= 3)). After removing these data points from both tasks, Task 1 consisted of 76 participants and Task 2 consisted of 67 participants.

Descriptive Statistics

Demographic information for participants who completed Tasks 1 and 2 are presented in Tables 1 and 2 below. A two-sided Welch's t-test showed that the mean age of participants taking part in the individualistic task (M= 8.54, SD = 1.95) was significantly higher than the mean age of those taking part in the cooperation task followed by the experiment (M= 6.72, SD = 2.14, $t(73.89)= -3.88$, $p < 0.05$, 95% Cis [-2.75, -0.88]). One possible explanation for this difference could be that younger children were more attracted to

play with LEGO Duplo blocks than older children. Another possibility is that since the participants in the experiment were all self-referred, that is they were recruited from visitors to the Glasgow Science Centre who were interested in the scientific exhibitions, it is possible that the older children were attracted to the experiment itself, whilst younger children were attracted to the LEGO Duplo blocks. For the purpose of analysis, I split the participants into two groups: representing Older (ages 7 and above) and Younger children (below 7 years). Shapiro Wilk test was conducted to check whether or not Age was normally distributed. The results, ($p < 0.05$) indicated that the scores are not normally distributed (see the histogram in Figure 3). Therefore, I conducted a two-sided Welch's t-test to confirm the split between the ages of Older (M= 9.53) and Younger (M= 5.68). The results, $t(73.28) = 14.88$, $p<0.05$, 95% Cis [3.33, 4.36]) indicated that children who were classed as Younger were indeed significantly younger than the Older children.

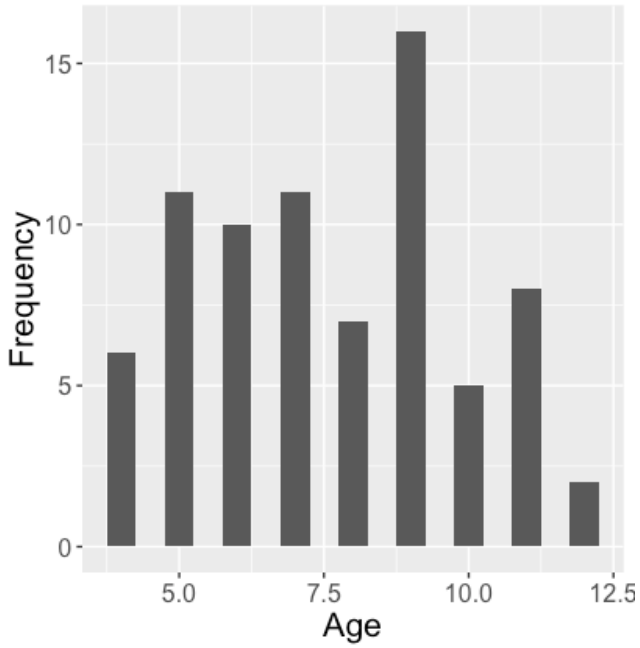

Figure 3. Histogram illustrating distribution for Age of all the participants.

Table 1. Mean estimates (with SD in parentheses) for Age, Trust Accuracy and Reaction Time (RT) for Task 1

	Cooperation Level	Young participants	Old participants	Total
N	Cooperation	27	12	39
	Individualistic	11	26	37
	Total	38	38	76
Age (years)	Cooperation	5.52 (1.05)	9.42 (1.31)	6.72 (2.14)
	Individualistic	6.09 (1.04)	9.58 (1.14)	8.54 (1.95)
	Total	5.58 (1.07)	9.53 (1.18)	7.61 (2.23)
Accuracy (%)	Cooperation	51.85 (10.42)	54.86 (15.27)	52.78 (11.99)
	Individualistic	54.55 (9.40)	55.77 (16.29)	55.41 (14.46)
	Total	52.63 (10.09)	55.48 (15.77)	54.06 (13.23)
RT (ms)	Cooperation	7294.65 (3438.35)	6889.54 (3181.59)	7170.00 (3324.90)
	Individualistic	7153.89 (2145.05)	6882.13 (4657.77)	6962.92 (4044.73)
	Total	7253.90 (3091.16)	6884.47 (4203.34)	7069.19 (3669.44)

Table 2. Mean estimates (with SD in parentheses) for Age and Trust Investment for Trustworthy and Untrustworthy looking faces for in Task 2

	Face Trustworthiness	Cooperation Level	Young participants	Old participants	Total
N	Trustworthy	Cooperation	20	12	32
		Individualistic	9	26	35
		Total	29	38	67
	Untrustworthy	Cooperation	20	12	32
		Individualistic	9	26	35
		Total	29	38	67
Age (years)	Trustworthy	Cooperation	5.80 (1.01)	9.42 (1.31)	15.22 (2.32)
		Individualistic	6.44 (0.73)	9.58 (1.14)	16.02 (1.87)
		Total	12.24 (1.74)	19 (2.45)	31.24 (4.19)
	Untrustworthy	Cooperation	5.80 (1.01)	9.42 (1.31)	15.22 (2.32)
		Individualistic	6.44 (0.73)	9.58 (1.14)	16.02 (1.87)
		Total	12.24 (1.74)	19 (2.45)	31.24 (4.19)
Trust Investment	Trustworthy	Cooperation	3.62 (0.79)	3.07 (0.47)	6.69 (1.26)
		Individualistic	3.10 (0.61)	3.06 (0.69)	6.16 (1.3)
		Total	6.72 (1.4)	6.13 (1.16)	12.85 (2.56)
	Untrustworthy	Cooperation	3.76 (0.70)	3.33 (0.67)	7.09 (1.37)
		Individualistic	3.68 (0.62)	3.11 (0.80)	6.79 (1.42)
		Total	7.44 (1.32)	6.44 (1.47)	13.88 (2.79)

Inferential statistics

Trust perception (Task 1)

Trustworthiness Accuracy, expressed as a percentage, was calculated as the proportion of time participants correctly selected the trustworthy faces in the 2AFC task. First, a Shapiro Wilk test was conducted to discover whether or not Trust Accuracy scores were normally distributed. The results, ($p < 0.05$) indicated that the scores are not normally distributed (see the histogram in Figure 4).

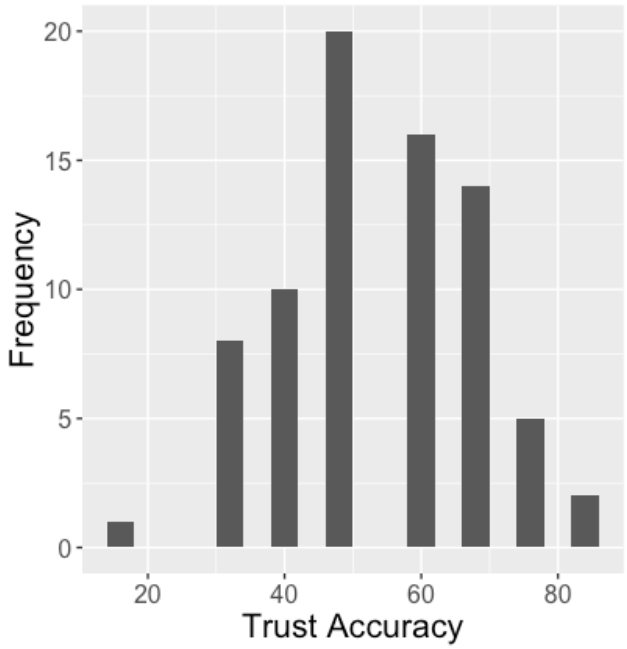

Figure 4. Histogram illustrating distribution for Trustworthiness Accuracy scores obtained in Task 1.

The effect of Cooperation level on Trust Accuracy for children of different age groups (Older and Younger) was tested in a between-subject 2 x 2 Analysis of Variance (ANOVA) with factors of Cooperation level (Cooperative vs Individualistic) and Age Group (Young vs Old). The first hypothesis stated there would be a significant difference in children's

trustworthiness judgement of faces following a cooperation priming task. ANOVA revealed that the main effect of Cooperation level *($F(1,72) = 0.29$, $p > 0.05$, $\eta_p^2 = 0.004$)* did not reach significance, indicating there was no difference in Trust Accuracy following the Cooperative (M= 52.78) and Individualistic (M= 55.41) priming conditions.

A second hypothesis stated that children below the age of 7 years would show poorer trustworthiness judgements than children over the age of 7 years. ANOVA revealed that the main effect of Age Group *($F(1,72) = 0.40$, $p > 0.05$, $\eta_p^2 = 0.005$)* did not reach significance, indicating there was no difference in Trust Accuracy between Younger (M= 52.63) and Older (M= 55.48) children. Finally, ANOVA also revealed that the interaction between Cooperation level and Age Group *($F(1,72) = 0.07$, $p > 0.05$, $\eta_p^2 = 0.0009$)* was non-significant. The results of this analysis are illustrated in Figure 5.

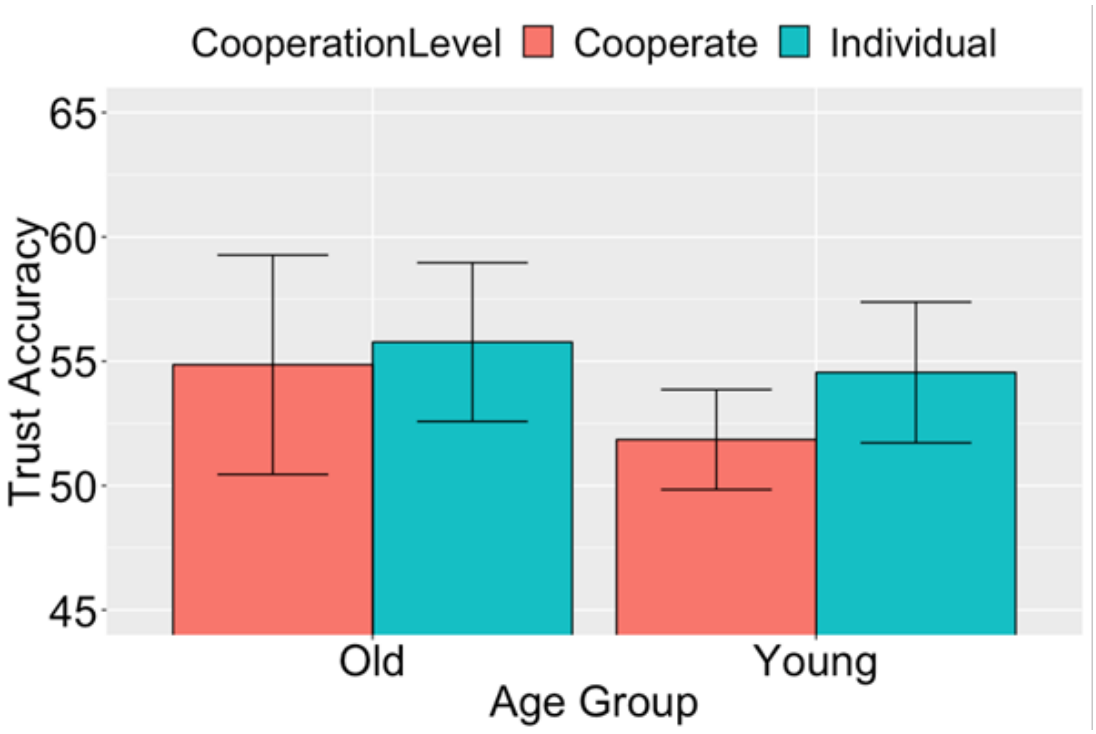

Figure 5. Mean Trustworthiness Accuracy following Cooperation and Individualistic priming conditions for Older and Younger participants. Error bars represent standard error of the mean (SEM).

Trust Investment (Task 2)

Trust Investment is the number of stickers participants invested with each of the trustworthy-looking and untrustworthy-looking faces. A Shapiro-Wilk test was conducted to find out whether Trust Investment scores were normally distributed. The results, ($p > 0.05$) indicated that the data are normally distributed (see the histogram in Figure 6).

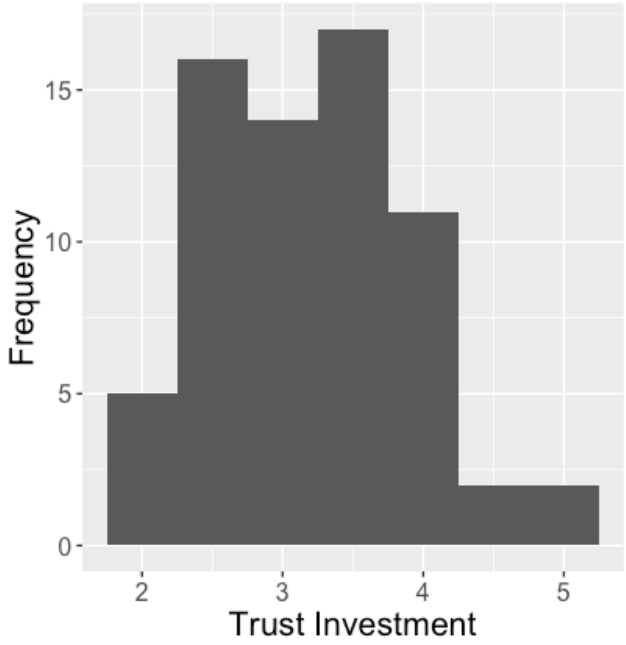

Figure 6. Histogram illustrating distribution for Trust Investment scores obtained in Task 2.

A 2 x 2 x 2 mixed ANOVA was employed to evaluate the effects of Cooperation level (Cooperative vs Individualistic), Age Group (Young vs Old) and Trust Level (Trustworthy and Untrustworthy faces). The first hypothesis stated that there would be a significant difference in children's trust investment with faces following a cooperation priming task. ANOVA revealed that the main effect of Cooperation level *($F(1,63) = 1.46$, $p > 0.05$, $\eta_p^2 =$*

0.019) did not reach significance, indicating there was no difference in Investment following Cooperative (M= 3.51) and Individualistic (M= 3.16) priming conditions.

A second hypothesis stated that children below the age of 7 years would show poorer trust judgements than children over the age of 7 years. ANOVA revealed a significant main effect of Age Group *($F(1,63) = 5.36$, $p < 0.05$, $\eta_p^2 = 0.067$)*, indicating that Younger children (M= 3.60) invest more Older children (M= 3.12).

A third hypothesis stated that participants would invest more with trustworthy faces compared to untrustworthy faces. ANOVA revealed a significant main effect of Trust level *($F(1,63) = 11.88$, $p < 0.01$, $\eta_p^2 = 0.028$)*, indicating that participants invested more with untrustworthy faces (M= 3.42) than with trustworthy faces (M= 3.24). Whilst a significant effect was detected as predicted, the association between the variables were in the opposite direction.

ANOVA revealed that the interaction between Cooperation level and Age Group *($F(1,63) = 0.30$, $p > 0.05$, $\eta_p^2 = 0.004$)* was non-significant. Moreover, ANOVA also revealed that the interaction between Cooperation level and Trust level *($F(1,63) = 0.58$, $p > 0.05$, $\eta_p^2 = 0.001$)* was non-significant. Finally, ANOVA revealed that the interaction between Trust level and Age Group *($F(1,63) = 1.91$, $p > 0.05$, $\eta_p^2 = 0.004$)* was also non-significant. The results of this analysis are illustrated in Figure 7.

However, there was a significant interaction between the three variables; Cooperation level, Trust level, and Age Group. The results, *($F(1,63) = 4.71$, $p < 0.05$, $\eta_p^2 = 0.011$)* indicate that younger children invest less with trustworthy faces following the individualistic task. The result of this analysis can also be seen in Figure 7.

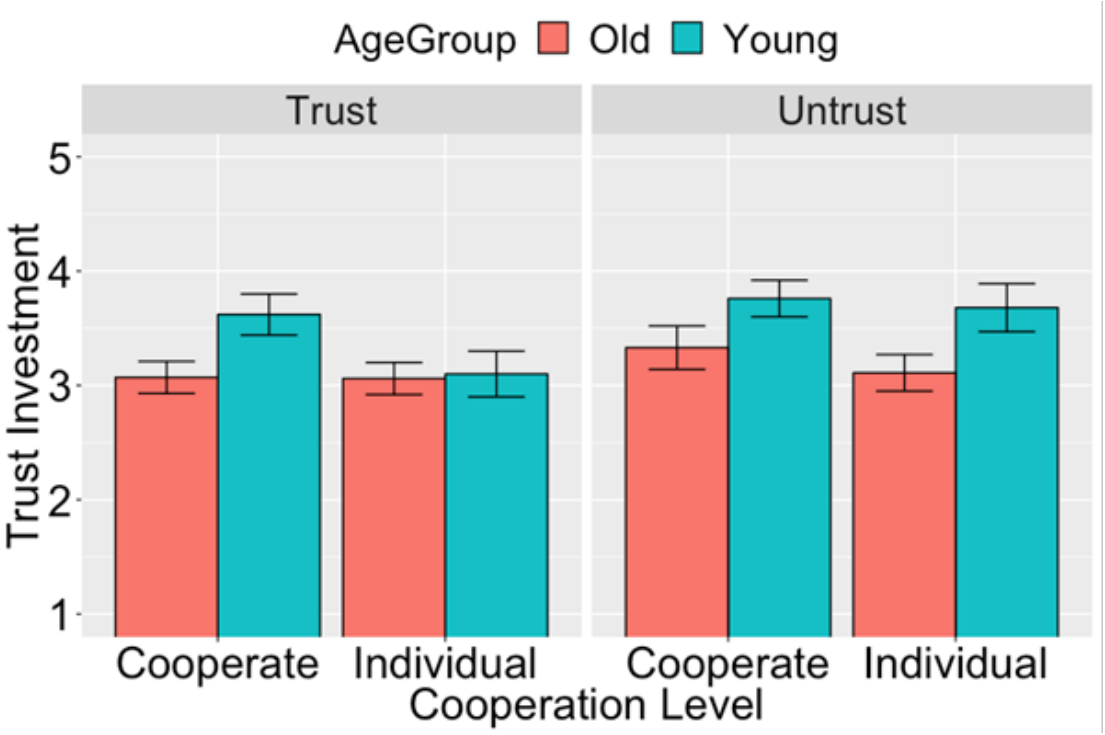

Figure 7. Mean Investments with Trustworthy and Untrustworthy faces following Cooperation and Individualistic priming condition for Older and Younger participants. Error bars represent standard SEM.

Discussion

The current study sought to investigate whether engaging in cooperative behaviour, such as playing with LEGO Duplo blocks, increases the accuracy of trustworthiness judgements in children. For the purpose of investigating this research question, two tasks were conducted. Trust perception task was designed to explore whether children can make accurate trust judgements. The participants were shown 6 pairs of faces that were digitally manipulated to project high and low levels of trustworthiness. Whilst the trust investment task was designed to examine children's willingness to trust the faces. The second aim of the experiment was to examine whether there is a difference in the trust judgements of Younger (below 7 years) and Older (age 7 and above) children between the ages of 4 to 12 years, following cooperation priming. Lastly, the third aim of the study was to determine whether children invest more trustworthy-looking faces or with untrustworthy-looking faces. These results were obtained by asking the participants to invest stickers with each of the trustworthy and untrustworthy stimulus types.

No statistically significant difference was found between the trust accuracy levels of children who were engaged in cooperation condition and individualistic condition. Similarly, no significant difference was found between the trust investment levels of the children involved in the two conditions. Additionally, in an interaction effect between cooperation level (cooperation vs individualistic condition) and trust investment level (trustworthy and untrustworthy faces), no statistically significant effect was determined. These results reveal an interesting profile of trust perception and investment decisions based on facial appearance after cooperation priming in children. Prior research has suggested that contextual information, such as information available about the stimuli's character (Delgado, Frank & Phelps, 2005) and brief social interactions (Frank, Gilovich & Regan, 1993) can influence the observer's trust judgements. Moreover, observer's previous immediate

experience, such as social stress (Toet, Bijlsma & Brouwer, 2017) and anxiety (Attwood et al, 2017) also has an impact on their subsequent trustworthiness judgements. This indicates that although trustworthiness judgements are made automatically and rapidly, they are sensitive to several internal and external factors as well. However, increased cooperative behaviour does not have an impact on the way children perceive trustworthiness through facial cues.

One possibility to explain the inconsistent results could be that, the degree to which the participants were primed with cooperation was not sufficient to reveal a significant difference in their trust judgements (trust accuracy and trust investment). Although it has been researched that playing with LEGO Duplo blocks promote prosocial behaviour and cooperation (Hu, Zheng & Lee, 2018; LeGoff, 2004), it's usage for cooperation priming may not be the best approach. Other methods, such as involving children to solve problems together (Caballero et al, 2013), encouraging them to play with LEGO Duplo blocks or other games in a larger group (Alencar, de Oliveira Siqueira & Yamamoto, 2008), showing a video about cooperation and other activities that involve creative learning (Dolšak & Hillyard, 2016) could be adopted to ensure a higher degree of cooperation priming.

Another possibility that could partially explain the reason for the obtained results would be, participants' comprehension of the tasks. The sample population involves very young children of the ages 4 years and above, so it is likely that the participants were too young to understand the nature of the task. For example, understanding the words 'trustworthiness' and 'judgement' must have been complex for them. Although age-appropriate words were used to explain the tasks to the participants, there is no confirmation of their understanding of the trust concepts. If the participants did not understand the task accurately, the data recovered from them could have impacted the validity of the results. It could be particularly challenging for future research to advocate possibilities to ensure that,

young children that have linguistic and cognitive limitations, understand and operationalize 'trust' as a concept.

Although the participants' mean trust accuracy and trust investment scores were different in the cooperation condition and individualistic condition (see Results section, for details), this was not statistically significant. Possibly due to the current sample size of the study. It may be helpful to design future studies with larger sample size, as it may reveal a better understanding of the relationship between cooperation and trustworthiness judgements.

The second hypothesis stated that there will be a significant difference between the trust perception of younger and older children. Existing literature revealed a marginally significant influence of age group on trust perception (Ewing et al, 2015). Whereas, the current study found no significant effect of age group on trust perception. A reason for inconsistency in the results could be due to the complexity of the task employed in the current study. The current study required the participants to choose between the same faces which were manipulated to project high and low levels of trustworthiness cues. Whereas, Ewing et al (2015) required the participants to rate different individual faces on a 7-point scale (1 = *not very trustworthy*, 7 = *very trustworthy*). This could, in part, explain that due to a comparatively more challenging task, it could have been confusing for the participants to differentiate between each of the faces shown. On the other hand, Ewing et al (2015) suggest that there is no significant difference between the trust investment behaviour of participants in different age groups. Consistent with these findings, the current study revealed no significant influence of age group on the trust investment of the participants. However, it would be necessary to further validate these results through a much larger sample population for the purpose of generalizability. The intriguing divergence in the findings of the two tasks

raises important questions for future research that may investigate why age has an impact on trust perception but not trust investment.

Another main effect of Age Group was revealed which indicated that the younger children invested more stickers than the older children. This indicates that younger children were motivated to engage in prosocial behaviour - they acted generously and were more open to giving away stickers in an economic investment paradigm. These findings are in contrast with previous research that indicated that young children (3-4 years old) behave rather parsimoniously and their generosity increase with age (Gummerum, Hanoch, Keller, Parsons & Hummel, 2010; Fehr, Rockenbach & Bernhard, 2008). However, in a recent study conducted by Leimgruber, Shaw, Santos & Olson (2012) it was revealed that young children act generously, but only in the presence of audience cues and when their resource allocations are made transparent. This implies that when the recipient of the allocated resources was visible to the children, and when children's allocations were visible to the public, they behaved systematically more generously. Therefore, it is possible that younger children invested more stickers because the experimenter was aware of the number of stickers, they provided to each of the faces. Overall, this implies that external factors impact children's motivation to behave pro-socially and generously. However, an interesting question is raised through this study. It is unknown if the facial cues of trustworthiness influenced the younger children's overall higher investments. Further research in this area could investigate if children's higher investments were contributed by audience cues or their awareness of the facial trustworthiness cues.

Finally, the third hypothesis stated that participants will invest more with trustworthy-looking faces in comparison with untrustworthy-looking faces. The current study found opposite results in this regard (such as Ewing et al, 2015; Chang et al, 2010; Ewing et al, 2015). In the trust investment task, a significant effect was revealed where the children

invested more with untrustworthy-looking faces. Also, a similar effect was seen in a three-way interaction between Cooperation level (cooperation and individualistic condition), Age group (younger and older participants) and Trust level (trustworthy and untrustworthy stimulus type). This interaction effect indicated that younger participants invested less with trustworthy-looking faces following the individualistic task. One possibility to explain this contradiction in the results would be that the participants were asked to judge faces that were manipulated digitally. Whereas, in the study conducted by Ewing et al (2015), they used internet sourced Caucasian faces with natural variations in facial cues, that were pre-rated on the trustworthiness dimension. So, it is possible that children perceive digitally manipulated faces differently from faces with natural variations. Real faces can be more obscure as they are not exclusively based on the changes in the parameters from a face perception prototype. Therefore, a comparison between the trustworthiness judgements of real and computer-generated faces would contribute further to the postulated hypothesis.

Moreover, the manipulations that were made to the faces could have been very subtle for the children to assess their trust levels accurately. Previous research has shown that due to underdeveloped cognitive ability in children, their judgements are limited to their face perception ability and the ability to pay attention to detail (Mondloch et al, 2003; Gilchrist & McKone, 2003). This factor could partially contribute to the contradictory results that were revealed in this study. Also, the faces were manipulated according to the cues that adults find trustworthy-looking or untrustworthy-looking (such as brow ridge, cheekbones, chin, and nose sellion) (Todorov, Baron & Oosterhof, 2008). It is also possible that children take into consideration a different set of cues while making judgements.

We know that appearances have a great impact on our social decisions. In extension, research has shown that emotion cues influence children's trustworthiness judgements (Tang, Harris, Zou & Xu, 2019). Children perceive happy-looking faces as

trustworthy and angry-looking faces as untrustworthy (Caulfield et al, 2016). Judgements are also made from neutral expressions based on the emotion cues that the observer perceives from the faces (Caulfield et al, 2016). However, Caulfield et al (2016) suggested that children identify subtle emotion cues from neutral expressions after the age of 10. It is evident that facial appearance and emotion cues facilitate the judgement making process in observers. Hence, another possibility could be that since the majority of the sample population was below the age of 10, they may have found it challenging to discern the trust levels from the faces, due to the subtle manipulations in their neutral expressions. To help choose between the different possibilities laid out above, it would be informative in future research to examine whether showing slightly less subtle manipulations will enhance children's judgements even in the absence of emotion cues.

Lastly, the concept of facial resemblance might be another interpretation of the obtained results. It has been researched that facial resemblance enhances social behaviour in adults (DeBruine, 2002). Adults tend to trust faces more if they perceive that the faces resemble them. This indicates that, due to facial resemblance, higher levels of prosocial behaviour is projected causing them to be more trusting in nature. Several theories have been proposed to explain this bias in adults. An explanation that stands out the most is that, self-resembling faces are perceived to be more attractive and that more attractive people are perceived to be more trustworthy (Schmidt, Levenstein & Ambadar, 2012; Scharlemann et al, 2001). Engaging in such behaviour is referred to as, phenotype matching. Phenotype matching involves implicit analysis of relatedness on the basis of trait-based evaluations of similarities in physical composition. These assessments can be done in two ways; through one's own phenotype or by associating the stimuli's phenotypic traits to one's close family members (DeBruine, 2002). Perhaps such influential factors exist in children that cause them to trust even untrustworthy-looking individuals. It would be interesting for future researchers

to investigate if children engage in such phenotype matching behaviour. Moreover, investigating if other implicit factors that impact children's social perception and behaviour would also be a substantial contribution to this area of research.

Limitations

The current findings should be interpreted upon consideration of some methodological limitations. Firstly, the experiment that I adopted was the same for participants of all ages. For example, it was found that the younger children (below the age of 7) were more fascinated by the LEGO task compared to the older (above the age of 7) children. It is possible that due to this reason, a significant difference in the age groups between cooperation condition and individualistic condition was found. Ensuring that there is an equal number of participants, with similar ages, between each group would be necessary to obtain substantial results. It is well known that developmental changes, such as cognitive and neural developments occur in children throughout their childhood (Ma, Xu & Luo, 2016), hence, this experiment could have been more age-sensitive and appropriate.

Another factor to consider would be that, participants were asked to judge adult faces, it is possible that due to the own-age bias (OAB) children were unable to make reliable judgements. Much research has suggested that own-age bias is a common phenomenon during facial recognition (Hills & Lewis, 2011; Anastasi & Rhodes, 2005). A recent study also has shown that children process faces of similar age better than faces of other ages, due to OAB (Hills, 2012). Furthermore, faces were restricted to a single-gender (i.e., female faces) to avoid biases in judgement due to gender stereotypes (Tang, Harris, Zou & Xu, 2019). Investigating whether a different pattern of judgements will be revealed with male faces or similar-age faces would be a valuable inquiry.

The data was collected at a public space; Glasgow Science Centre, which is comparatively a noisier place for data collection with children than other locations. During the course of the experiment, there was a presence of many distractions that could have restricted the reliability of the data. For example, participants could have been distracted by other experiments and games set up for them to play with, causing them to not focus on the study under question. Much of the experiment required the participants to look at the computer screen. Often there was light glaring at the screen which might have hampered the participants' judgements.

Previous literature has evidenced that higher levels of cooperativeness lead to increased prosocial behaviours and meta-cognitive abilities (Heydenberk & Heydenberk, 2005; Drouvelis, Metcalfe & Powdthavee, 2010). Possessing the ability to make accurate trust judgements is crucial for a child's safety and well-being. Since the current study is the first to evaluate the impact of cooperative behaviour on trustworthiness judgments, the results are limited due to its shortcomings. Therefore, considering the aforementioned limitations in future research could provide a valuable contribution to the understanding of the postulated hypothesis.

Future Directions

Information about a child's everyday interpersonal functioning would be useful to successfully prime the children. Attempts to prime a child, who is generally not a cooperative individual, could be ineffective until the degree to which they ought to be primed is known. In a recent study conducted by Malti, Ongley, Peplak, Chaparro, Buchmann, Zuffianò & Cui (2016) the authors asked the parents or caregivers to rate children's cooperation level and social behaviour, using Social Skills Rating System (SSSR) and Social Competence and Behaviour Evaluation (SCBE). Using self-report questionnaires such as the

Pictorial Scale of Perceived Competence and Social Acceptance for Young Children may also be necessary to understand children's social competence (see Lam, Tam, Chung & Li, 2018, for similar decision). Since social competence is an important factor of cooperation, it's usage may result in improved reliability of cooperation task (Rubin, Bukowski & Laursen, 2011). For this reason, using these established questionnaires may provide future researchers with the additional data that they need to analyse the extent to which cooperative behaviour has an impact on trust judgments.

Moreover, trustworthiness judgements are typically not made in isolation. It is well known that humans are influenced by particular cognitive biases during judgement making. The concept of availability bias may be an important predictor (Kay & Ross (2003). After sufficient cooperation priming, it is possible that children are impacted by availability bias, as cooperativeness would be cognitively available to them. Then, children may be more likely to perceive and expect cooperation from others, thereby swaying their judgements about trust perception. This could also provide further explanation of whether cooperative behaviour improves trustworthiness judgements, or it causes no impact at all. Future research in this regard would be a fascinating direction of research, as it could contribute to establishing a more definite relationship between cooperation and trustworthiness judgement.

Finally, another interesting avenue for future research could be to explore and compare cultural differences in the levels of cooperativeness of children, which may further impact their trust behaviour. This direction of exploration would be particularly interesting, as it would add to the existing research about the differences in the collectivist and individualistic societies.

Conclusion

The current study aimed at addressing a gap in the literature regarding the different factors that may influence trustworthiness judgments. In sum, the results reveal that engaging in cooperative activities does not have a significant influence on children's subsequent trust perception and trust investment behaviour. It was also revealed that there is no significant difference between the trust judgements of younger and older children. A contradictory yet interesting result was also reported, that is, children invested more with untrustworthy faces than trustworthy faces. Lastly, it was investigated that younger children invest more stickers than older children. As discussed earlier, increased trust beliefs and behaviour are associated with a child's academic achievement, social adjustment, and general well-being. Since cooperation is widely encouraged in schools and during play, further examination of the relationship between cooperation and trust behaviour will possess valuable implications. It may aid to the enhancement of children's experiences throughout childhood. The results of the current study provide a valuable starting point for future research. Several domains within this research can be explored in the future in order to provide conclusive proof about the relationship between cooperation and trust behaviour.

References

Alencar, A. I., de Oliveira Siqueira, J., & Yamamoto, M. E. (2008). Does group size matter? Cheating and cooperation in Brazilian school children. *Evolution and HumanBehavior*, *29*(1), 42-48.

Anastasi, J. S., & Rhodes, M. G. (2005). An own-age bias in face recognition for children and older adults. *Psychonomic Bulletin & Review, 12*(6), 1043-1047. doi:10.3758/BF03206441

Arthur S. P. Jansen, Nguyen, X. V., Karpitskiy, V., Mettenleiter, T. C., & Loewy, A. D. (1995). Central command neurons of the sympathetic nervous system: Basis of the fight-or-flight response. *Science, 270*(5236), 644-646. doi:10.1126/science.270.5236.644

Artut, P. D. (2009). Experimental evaluation of the effects of cooperative learning on kindergarten children's mathematics ability. *International Journal of Educational Research, 48*(6), 370-380. doi:10.1016/j.ijer.2010.04.001

Attwood, A. S., Easey, K. E., Dalili, M. N., Skinner, A. L., Woods, A., Crick, L., . . . Munafò, M. R. (2017). State anxiety and emotional face recognition in healthy volunteers. *Royal Society Open Science, 4*(5), 160855-160855. doi:10.1098/rsos.160855

Aylward, E. H., Park, J. E., Field, K. M., Parsons, A. C., Richards, T. L., Cramer, S. C., & Meltzoff, A. N. (2005). Brain activation during face perception: Evidence of a developmental change. *Journal of Cognitive Neuroscience, 17*(2), 308-319. doi:10.1162/0898929053124884

Ballew, C. C., & Todorov, A. (2007). Predicting political elections from rapid and unreflective face judgments. *Proceedings of the National Academy of Sciences of the United States of America, 104*(46), 17948-17953. doi:10.1073/pnas.0705435104

Balliet, D. P., & van Lange, P. A. M. (2013). Trust, conflict and cooperation: A meta-analysis. *Psychological Bulletin, 139*(5), 1090-1112. doi:10.1037/a0030939

Bandura, A., & Walters, R. H. (1977). *Social learning theory*(Vol. 1). Englewood Cliffs, NJ: Prentice-hall.

Bar, M., Neta, M., & Linz, H. (2006). Very first impressions. *Emotion, 6*(2), 269-278. doi:10.1037/1528-3542.6.2.269

Bennett, J., Espie, C., Duncan, B., & Minnis, H. (2009). A qualitative exploration of children's understanding of indiscriminate friendliness. *Clinical Child Psychology and Psychiatry, 14*(4), 595.

Benson, P. J., & Perrett, D. I. (1991). Synthesising continuous-tone caricatures. *Image and Vision Computing, 9*(2), 123-129. doi:10.1016/0262-8856(91)90022-H

Berg, J., Dickhaut, J., & McCabe, K. (1995). Trust, reciprocity, and social history. *Games and Economic Behavior, 10*(1), 122-142. doi:10.1006/game.1995.1027

Birkás, B., Dzhelyova, M., Lábadi, B., Bereczkei, T., & Perrett, D. I. (2014). Cross-cultural perception of trustworthiness: The effect of ethnicity features on evaluation of faces' observed trustworthiness across four samples. *Personality and Individual Differences, 69*, 56-61. doi:10.1016/j.paid.2014.05.012

Buckingham, G., DeBruine, L. M., Little, A. C., Welling, L. L. M., Conway, C. A., Tiddeman, B. P., & Jones, B. C. (2006). Visual adaptation to masculine and feminine faces influences generalized preferences and perceptions of trustworthiness. *Evolution and Human Behavior, 27*(5), 381-389. doi:10.1016/j.evolhumbehav.2006.03.001

Caballero, F. S., i Sellabona, E. S., Serrano, J., Sánchez, C. R., Caño, A., & Codony, A. A. (2013). Let's share perspectives! Mentalistic skills involved in cooperation. *International Journal of Educational Psychology: IJEP*, *2*(3), 325-352.

Caulfield, F., Ewing, L., Bank, S., & Rhodes, G. (2016). Judging trustworthiness from faces: Emotion cues modulate trustworthiness judgments in young children. *British Journal of Psychology, 107*(3), 503-518.

Chang, L. J., Doll, B. B., van 't Wout, M., Frank, M. J., & Sanfey, A. G. (2010). Seeing is believing: Trustworthiness as a dynamic belief. *Cognitive Psychology, 61*(2), 87-105. doi:10.1016/j.cogpsych.2010.03.001

Cogsdill, E. J., & Banaji, M. R. (2015). Face-trait inferences show robust child–adult agreement: Evidence from three types of faces. *Journal of Experimental Social Psychology, 60*, 150-156.

Cogsdill, E. J., Todorov, A. T., Spelke, E. S., & Banaji, M. R. (2014). Inferring character from faces: A developmental study. *Psychological Science, 25*(5), 1132-1139. doi:10.1177/0956797614523297

Cooper, P. A., Geldart, S. S., Mondloch, C. J., & Maurer, D. (2006). Developmental changes in perceptions of attractiveness: A role of experience? *Developmental Science, 9*(5), 530-543. doi:10.1111/j.1467-7687.2006.00520.x

Davidov, M., Zahn-Waxler, C., Roth-Hanania, R., & Knafo, A. (2013). Concern for others in the first year of life: Theory, evidence, and avenues for research. *Child Development Perspectives, 7*(2), 126-131. doi:10.1111/cdep.12028

DeBruine, L. M. (2002). Facial resemblance enhances trust. *Proceedings of the Royal Society of London. Series B: Biological Sciences, 269*(1498), 1307-1312. doi:10.1098/rspb.2002.2034

Delgado, M. R., Frank, R. H., & Phelps, E. A. (2005). Perceptions of moral character modulate the neural systems of reward during the trust game. *Nature Neuroscience, 8*(11), 1611-1618. doi:10.1038/nn1575

Dolšak, N., & Hillyard, C. (2016). Creative Learning to Foster Cooperation. *Creative Learning in Higher Education: International Perspectives and Approaches*.

Drouvelis, M., Metcalfe, R., & Powdthavee, N. (2010). Priming cooperation in social dilemma games.

Dunfield, K., Kuhlmeier, V. A., O'Connell, L., & Kelley, E. (2011). Examining the diversity of prosocial behavior: Helping, sharing, and comforting in infancy. *Infancy, 16*(3), 227-247.

Dzhelyova, M., Perrett, D. I., & Jentzsch, I. (2011;2012;). Temporal dynamics of trustworthiness perception. *Brain Research, 1435*, 81-90. doi:10.1016/j.brainres.2011.11.043

Engell, A. D., Haxby, J. V., & Todorov, A. (2007). Implicit trustworthiness decisions: Automatic coding of face properties in the human amygdala. *Journal of Cognitive Neuroscience, 19*(9), 1508-1519. doi:10.1162/jocn.2007.19.9.1508

Erikson, E. H. (1963). *Childhood in society.* New York, NY: Norton. Frankel, A., & Prentice-Dunn, S. (1990). Loneliness and the pro- cessing of self-relevant information. *Journal of Social and Clinical Psychology, 9*, 303-315.

Ert, E., Fleischer, A., & Magen, N. (2016). Trust and reputation in the sharing economy: The role of personal photos in airbnb. *Tourism Management, 55*, 62-73. doi:10.1016/j.tourman.2016.01.013

Ewing, L., Caulfield, F., Read, A., & Rhodes, G. (2015). Appearance-based trust behaviour is reduced in children with autism spectrum disorder. *Autism*, *19*(8), 1002-1009.

Ewing, L., Caulfield, F., Read, A., & Rhodes, G. (2015). Perceived trustworthiness of faces drives trust behaviour in children. *Developmental Science*, *18*(2), 327-334.

Fehr, E., Rockenbach, B., & Bernhard, H. (2008). Egalitarianism in young children. *Nature*, *454*(7208), 1079-1083. doi:10.1038/nature07155

Frank, R. H., Gilovich, T., & Regan, D. T. (1993). The evolution of one-shot cooperation: An experiment. *Ethology and Sociobiology, 14*(4), 247-256. doi:10.1016/0162-3095(93)90020-I

Gennari, R., Melonio, A., Raccanello, D., Brondino, M., Dodero, G., Pasini, M., & Torello, S. (2017). Children's emotions and quality of products in participatory game design. *International Journal of Human-Computer Studies*, *101*, 45-61.

Gilchrist, A., & McKone, E. (2003). Early maturity of face processing in children: Local and relational distinctiveness effects in 7-year-olds. *Visual Cognition, 10*(7), 769-793. doi:10.1080/13506280344000022

Goddard, R. D. (2003). Relational networks, social trust, and norms: A social capital perspective on students' chances of academic success. *Educational Evaluation and Policy Analysis, 25*(1), 59-74. doi:10.3102/01623737025001059

Gummerum, M., Hanoch, Y., Keller, M., Parsons, K., & Hummel, A. (2010). Preschoolers' allocations in the dictator game: The role of moral emotions. *Journal of Economic Psychology, 31*(1), 25-34. doi:10.1016/j.joep.2009.09.002

Harris, P. L., & Corriveau, K. H. (2011). Young children's selective trust in informants. *Philosophical Transactions: Biological Sciences, 366*(1567), 1179-1187. doi:10.1098/rstb.2010.0321

Heydenberk, R. A., & Heydenberk, W. R. (2005). Increasing meta-cognitive competence through conflict resolution. *Education and Urban Society, 37*(4), 431-452. doi:10.1177/0013124505277747

Hills, P. J. (2012). A developmental study of the own-age face recognition bias in children. *Developmental Psychology, 48*(2), 499-508. doi:10.1037/a0026524

Hills, P. J., & Lewis, M. B. (2011). Rapid communication: The own-age face recognition bias in children and adults. *Quarterly Journal of Experimental Psychology, 64*(1), 17-23. doi:10.1080/17470218.2010.537926

Hodges, J., & Tizard, B. (1989). Social and family relationships of ex-institutional adolescents. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 30*(1), 77-97. doi:10.1111/j.1469-7610.1989.tb00770.x

Honk, J. v., Eisenegger, C., Terburg, D., Stein, D. J., & Morgan, B. (2013). Generous economic investments after basolateral amygdala damage. *Proceedings of the National*

Academy of Sciences of the United States of America, 110(7), 2506-2510. doi:10.1073/pnas.1217316110

Hooper, J. J., Sutherland, C. A. M., Ewing, L., Langdon, R., Caruana, N., Connaughton, E., . . . Rhodes, G. (2018). Should I trust you? autistic traits predict reduced appearance-based trust decisions. *British Journal of Psychology (London, England : 1953),* doi:10.1111/bjop.12357

Hu, X., Zheng, Q., & Lee, G. T. (2018). Using peer-mediated LEGO® play intervention to improve social interactions for Chinese children with autism in an inclusive setting. *Journal of Autism and Developmental Disorders, 48*(7), 2444-2457. doi:10.1007/s10803-018-3502-4

Jones, G. R., & George, J. M. (1998). the experience and evolution of trust: Implications for cooperation and teamwork. *Academy of Management Review, 23*(3), 531-546. doi:10.5465/AMR.1998.926625

Kahneman, D. (2003). A perspective on judgment and choice: Mapping bounded rationality. *American Psychologist, 58*(9), 697-720. doi:10.1037/0003-066X.58.9.697

Kay, A. C., & Ross, L. (2003). The perceptual push: The interplay of implicit cues and explicit situational construals on behavioral intentions in the prisoner's dilemma. *Journal of Experimental Social Psychology, 39*(6), 634.

Laible, D., Carlo, G., Murphy, T., Augustine, M., & Roesch, S. (2014). Predicting children's prosocial and co-operative behavior from their temperamental profiles: A person-centered approach: Prosocial behavior and temperamental profiles. *Social Development,* , n/a. doi:10.1111/sode.12072

Lakens, D. (2015). Always use Welch's t-test instead of Student's t-test. *Blog post*, 513-530.

Lam, C. B., Tam, C. Y. S., Chung, K. K. H., & Li, X. (2018). The link between coparenting cooperation and child social competence: The moderating role of child negative affect. *Journal of Family Psychology : JFP : Journal of the Division of Family Psychology of the American Psychological Association (Division 43), 32*(5), 692-698. doi:10.1037/fam0000428

Langlois, J. H., Kalakanis, L., Rubenstein, A. J., Larson, A., Hallam, M., & Smoot, M. (2000). Maxims or myths of beauty? A meta-analytic and theoretical review. *Psychological Bulletin, 126*(3), 390-423. doi:10.1037/0033-2909.126.3.390

Larson, J. J., Whitton, S. W., Hauser, S. T., & Allen, J. P. (2007). Being close and being social: Peer ratings of distinct aspects of young adult social competence. *Journal of Personality Assessment, 89*(2), 136-148. doi:10.1080/00223890701468501

LeGoff, D. B. (2004). Use of LEGO© as a therapeutic medium for improving social competence. *Journal of Autism and Developmental Disorders, 34*(5), 557-571. doi:10.1007/s10803-004-2550-0

Leimgruber, K. L., Shaw, A., Santos, L. R., & Olson, K. R. (2012). Young children are more generous when others are aware of their actions. *PloS One, 7*(10), e48292-e48292. doi:10.1371/journal.pone.0048292

Lieberman, A. F. (2003). The treatment of attachment disorder in infancy and early childhood: Reflections from clinical intervention with later-adopted foster care

children.*Attachment & Human Development, 5*(3), 279-282. doi:10.1080/14616730310001596133

Ma, D. S., Correll, J., & Wittenbrink, B. (2015). The chicago face database: A free stimulus set of faces and norming data. *Behavior Research Methods, 47*(4), 1122-1135. doi:10.3758/s13428-014-0532-5

Ma, F., Xu, F., & Luo, X. (2016). Children's facial trustworthiness judgments: Agreement and relationship with facial attractiveness. *Frontiers in Psychology, 7*, 499-499. doi:10.3389/fpsyg.2016.00499

Malti, T., Ongley, S. F., Peplak, J., Chaparro, M. P., Buchmann, M., Zuffianò, A., & Cui, L. (2016). Children's sympathy, guilt, and moral reasoning in helping, cooperation, and sharing: A 6-Year longitudinal study. *Child Development, 87*(6), 1783-1795. doi:10.1111/cdev.12632

Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An integrative model of organizational trust. *The Academy of Management Review, 20*(3), 709-734. doi:10.2307/258792

Miellet, S., Caldara, R., Gillberg, C., Raju, M., & Minnis, H. (2014). Disinhibited reactive attachment disorder symptoms impair social judgements from faces. *Psychiatry research, 215*(3), 747-752.

Moll, H., & Tomasello, M. (2007). Cooperation and human cognition: The vygotskian intelligence hypothesis. *Philosophical Transactions of the Royal Society B: Biological Sciences, 362*(1480), 639-648. doi:10.1098/rstb.2006.2000

Mondloch, C. J., Geldart, S., Maurer, D., & Grand, R. L. (2003). Developmental changes in face processing skills. *Journal of Experimental Child Psychology, 86*(1), 67-84. doi:10.1016/S0022-0965(03)00102-4

Mondloch, C. J., Le Grand, R., & Maurer, D. (2009). Development of expertise in face recognition. (pp. 67-107) Oxford University Press. doi:10.1093/acprof:oso/9780195309607.003.0004

Mondloch, C. J., Maurer, D., & Ahola, S. (2006). Becoming a face expert. *Psychological Science, 17*(11), 930-934. doi:10.1111/j.1467-9280.2006.01806.x

Naumann, L. P., Vazire, S., Rentfrow, P. J., & Gosling, S. D. (2009). Personality judgments based on physical appearance. *Personality and Social Psychology Bulletin, 35*(12), 1661-1671. doi:10.1177/0146167209346309

Nesse, R. M., Bhatnagar, S., & Ellis, B. (2016). Evolutionary origins and functions of the stress response system. In *Stress: concepts, cognition, emotion, and behavior* (pp. 95-101). Academic Press.

Olson, K. R., & Spelke, E. S. (2008). Foundations of cooperation in young children. *Cognition, 108*(1), 222-231.

Oosterhof, N. N., & Todorov, A. (2008). The functional basis of face evaluation. *Proceedings of the National Academy of Sciences of the United States of America, 105*(32), 11087-11092. doi:10.1073/pnas.0805664105

Piaget, J. (1932). *The Moral Judgment of the Child*. London: Routledge & Keegan Paul.

Quinn, P. C., Kelly, D. J., Lee, K., Pascalis, O., & Slater, A. M. (2008). Preference for attractive faces in human infants extends beyond conspecifics. *Developmental Science, 11*(1), 76-83. doi:10.1111/j.1467-7687.2007.00647.x

Ramani, G. B. (2006). *Cooperative play and problem solving in preschool children* (Doctoral dissertation, University of Pittsburgh).

Ramani, G. B., & Brownell, C. A. (2014). Preschoolers' cooperative problem solving: Integrating play and problem solving. *Journal of Early Childhood Research, 12*(1), 92-108. doi:10.1177/1476718X13498337

Re, D. E., & Perrett, D. I. (2014). The effects of facial adiposity on attractiveness and perceived leadership ability. *The Quarterly Journal of Experimental Psychology*, *67*(4), 676-686.

Rhodes, M., Hetherington, C., Brink, K., & Wellman, H. M. (2015). Infants' use of social partnerships to predict behavior. *Developmental science*, *18*(6), 909-916.

Rojas, M., Masip, D., Todorov, A., & Vitria, J. (2011). Automatic prediction of facial trait judgments: Appearance vs. structural models. *PloS One, 6*(8), e23323. doi:10.1371/journal.pone.0023323

Rotenberg, K. J. (1994). Loneliness and interpersonal trust. *Journal of Social and Clinical Psychology, 13*(2), 152-173. doi:10.1521/jscp.1994.13.2.152

Rotenberg, K. J. (2001). Trust across the life-span. In N. J. Smelser & P. B. Bates (Eds.). *International Encyclopedia of the Social and Behavioral Sciences* (pp. 7866–7868). New York: Pergamon.

Rotenberg, K. J., Addis, N., Betts, L. R., Corrigan, A., Fox, C., Hobson, Z., . . . Boulton, M. J. (2010). The relation between trust beliefs and loneliness during early childhood, middle childhood, and adulthood. *Personality and Social Psychology Bulletin, 36*(8), 1086-1100. doi:10.1177/0146167210374957

Rotenberg, K. J., Boulton, M. J., & Fox, C. L. (2005). Cross-sectional and longitudinal relations among children's trust beliefs, psychological maladjustment and social relationships: Are very high as well as very low trusting children at risk? *Journal of Abnormal Child Psychology, 33*(5), 595-610. doi:10.1007/s10802-005-6740-9

Rotenberg, K. J., Fox, C., Green, S., Ruderman, L., Slater, K., Stevens, K., & Carlo, G. (2005). Construction and validation of a children's interpersonal trust belief scale. *British Journal of Developmental Psychology*, *23*(2), 271-293.

Rowland, D. A., & Perrett, D. I. (1995). Manipulating facial appearance through shape and color. *IEEE computer graphics and applications*, *15*(5), 70-76.

Rubin, K. H., Bukowski, W. M., & Laursen, B. (Eds.). (2011). *Handbook of peer interactions, relationships, and groups*. Guilford Press.

Rule, N. O., Krendl, A. C., Ivcevic, Z., & Ambady, N. (2013). Accuracy and consensus in judgments of trustworthiness from faces: Behavioral and neural correlates. *Journal of Personality and Social Psychology, 104*(3), 409-426. doi:10.1037/a0031050

Rutter, M., Kreppner, J., & Sonuga-Barke, E. (2009). Emanuel miller lecture: Attachment insecurity, disinhibited attachment, and attachment disorders: Where do research findings leave the concepts? *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 50*(5), 529-543. doi:10.1111/j.1469-7610.2009.02042.x

Ruxton, G. D., Wilkinson, D. M., & Neuhäuser, M. (2015). Advice on testing the null hypothesis that a sample is drawn from a normal distribution. *Animal Behaviour, 107*, 249-252. doi:10.1016/j.anbehav.2015.07.006

Rychen, D. S., & Salganik, L. H. (2002). Definition and Selection of Competencies (DESECO): Theoretical and Conceptual Foundations. Strategy Paper. *Neuchâtel: Organisation for Economic Co-operation and Development (OECD).*

Sakai, A. (2010). Children's sense of trust in significant others: Genetic versus environmental contributions and buffer to life stressors. *Interpersonal trust during childhood and adolescence*, 56-84.

Scharlemann, J. P. W., Eckel, C. C., Kacelnik, A., & Wilson, R. K. (2001). The value of a smile: Game theory with a human face. *Journal of Economic Psychology, 22*(5), 617-640. doi:10.1016/S0167-4870(01)00059-9

Schmider, E., Ziegler, M., Danay, E., Beyer, L., & Bühner, M. (2010). Is it really robust?: Reinvestigating the robustness of ANOVA against violations of the normal distribution assumption. *Methodology, 6*(4), 147-151. doi:10.1027/1614-2241/a000016

Schmidt, K., Levenstein, R., & Ambadar, Z. (2012). Intensity of smiling and attractiveness as facial signals of trustworthiness in women. *Perceptual and Motor Skills, 114*(3), 964-978. doi:10.2466/07.09.21.PMS.114.3.964-978

Slocombe, K. E., & Seed, A. M. (2019). Cooperation in children. *Current Biology, 29*(11), R470-R473. doi:10.1016/j.cub.2019.01.066

Strange, B. A., Winston, J. S., O'Doherty, J., & Dolan, R. J. (2002). Automatic and intentional brain responses during evaluation of trustworthiness of faces. *Nature Neuroscience, 5*(3), 277-283. doi:10.1038/nn816

Sutherland, C. A. M., Liu, X., Zhang, L., Chu, Y., Oldmeadow, J. A., & Young, A. W. (2018). Facial first impressions across culture: Data-driven modeling of Chinese and British perceivers' unconstrained facial impressions. Personality and Social Psychology Bulletin, 44(4), 521– 537. https://doi.org/10.1177/0146167217744194

Tang, Y., Harris, P. L., Zou, H., & Xu, Q. (2019). The impact of emotional expressions on children's trust judgments. *Cognition and Emotion, 33*(2), 318-331. doi:10.1080/02699931.2018.1449735

Tiddeman, B., Burt, M., & Perrett, D. (2001). Prototyping and transforming facial textures for perception research. *IEEE Computer Graphics and Applications, 21*(5), 42-50. doi:10.1109/38.946630

Todorov, A. (2008). Evaluating faces on trustworthiness: An extension of systems for recognition of emotions signaling Approach Avoidance behaviors. *Annals of the New York Academy of Sciences, 1124*(1), 208-224. doi:10.1196/annals.1440.012

Todorov, A., Baron, S. G., & Oosterhof, N. N. (2008). Evaluating face trustworthiness: A model based approach. *Social Cognitive and Affective Neuroscience, 3*(2), 119-127. doi:10.1093/scan/nsn009

Todorov, A., Mandisodza, A. N., Goren, A., & Hall, C. C. (2005). Inferences of competence from faces predict election outcomes. *Science, 308*(5728), 1623-1626. doi:10.1126/science.1110589

Toet, A., Bijlsma, M., & Brouwer, A. (2017). Stress response and facial trustworthiness judgments in civilians and military. *SAGE Open, 7*(3), 215824401772538. doi:10.1177/2158244017725386

Tomasello, M. (2007). Cooperation and communication in the 2nd year of life. *Child Development Perspectives, 1*(1), 8-12. doi:10.1111/j.1750-8606.2007.00003.x

Vanderbilt, K. E., Liu, D., & Heyman, G. D. (2011). The development of distrust. *Child development*, *82*(5), 1372-1380.

Verosky, S. C., Porter, J., Martinez, J. E., & Todorov, A. (2018). Robust effects of affective person learning on evaluation of faces. *Journal of Personality and Social Psychology, 114*(4), 516-528. doi:10.1037/pspa0000109

Vuilleumier, P., Armony, J. L., Driver, J., & Dolan, R. J. (2001). Effects of attention and emotion on face processing in the human brain: An event-related fMRI study. *Neuron, 30*(3), 829-841. doi:10.1016/S0896-6273(01)00328-2

Vygotsky, L. S. (1962). *Thought and language*. Cambridge, MA: Harvard University Press.

Vygotsky, L. S. (1976). Play and its role in the mental development of the child. In J. S. Bruner, A. Jolly, & K. Sylva (Eds.), *Play* (pp. 537-559). New York: Harper & Row.

Vygotsky, L.S. (1978). *Mind in Society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Warneken, F., Chen, F., & Tomasello, M. (2006). Cooperative activities in young children and chimpanzees. *Child development*, *77*(3), 640-663.

Willis, J., & Todorov, A. (2006). First impressions: Making up your mind after a 100-ms exposure to a face. *Psychological Science, 17*(7), 592-598. doi:10.1111/j.1467-9280.2006.01750.x

Wincenciak, J., Dzhelyova, M., Perrett, D. I., & Barraclough, N. E. (2013). Adaptation to facial trustworthiness is different in female and male observers. *Vision Research, 87*, 30-34. doi:10.1016/j.visres.2013.05.007

Xu, F., Wu, D., Toriyama, R., Ma, F., Itakura, S., & Lee, K. (2012). Similarities and differences in chinese and caucasian adults' use of facial cues for trustworthiness judgments. *PloS One, 7*(4), e34859. doi:10.1371/journal.pone.0034859

Zebrowitz, L. (2018). *Reading faces: Window to the soul?*. Routledge.

Zebrowitz, L. A., & Montepare, J. M. (2005). Appearance DOES matter. *Science, 308*(5728), 1565-1566.

Appendix

University of Glasgow | School of Education

16 April 2019

Dear Ayushi Agarwal

School of Education Research Ethics Committee

Project Title: Cooperation and trustworthiness perception in children

Application No: 402180064

The School of Education Research Ethics Committee has reviewed your application and has agreed that there is no objection on ethical grounds to the proposed study. It is happy therefore to approve the project, subject to the following conditions:

- Start date of ethical approval: 16 April 2019
- Project end date: 31 December 2019
- Any outstanding permissions needed from third parties in order to recruit research participants or to access facilities or venues for research purposes must be obtained in writing and submitted to the School of Education Research Ethics Administrator before research commences. Permissions you must provide are shown in the reviewer feedback form, titled *Notification of Ethics Application Outcome*, that has been sent to you.
- Data collected should be held securely for the period you indicated in the application and any personal data collected should be appropriately managed in accordance with the General Data Protection Regulation.
- The research should be carried out only on the sites, and/or with the groups and using the methods defined in the application.
- Any proposed changes in the protocol should be submitted for reassessment as an amendment to the original application. The *Request for Amendments to an Approved Application* form should be used: https://www.gla.ac.uk/schools/education/research/ethics/forms/

Yours sincerely,

Dr Kara Makara
School of Education Ethics Officer

Dr Kara Makara, Lecturer
School of Education Ethics Officer
University of Glasgow
School of Education, St Andrew's Building, 11 Eldon Street
Glasgow G3 6NH
0044+141-330-5386 Kara.MakaraFuller@glasgow.ac.uk