PERCEPTIONS OF INTELLIGENCE AND THE ATTRACTIVENESS HALO

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A Thesis Submitted for the Degree of PhD
at the
University of St Andrews

2016

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This thesis is submitted in partial fulfilment for the degree of

PhD

at the

University of St Andrews

Date of Submission

November 18th, 2015

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I, Sean N. Talamas, hereby certify that this thesis, which is approximately 37,000 words in length, has been written by me, and that it is the record of work carried out by me, or principally by myself in collaboration with others as acknowledged, and that it has not been submitted in any previous application for a higher degree.

I was admitted as a research student in January 2014 and as a candidate for the degree of PhD in January 2014 (direct entry into second year of PhD studies); the higher study for which this is a record was carried out in the University of St Andrews between January 2014 and November 2015.

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Collaboration Statement

Throughout the experimental chapters in this thesis, I have used the pronoun ñweò in addition to ñIò. This work is my own under the support of my supervisor in terms of hypotheses, experimental design, analyses and conclusions; however, the Perception Lab is an inherently collaborative environment. The plural pronoun reflects the fact that if/when published; the following experiments would carry multiple authors and is used in keeping with intellectual honesty.

This thesis is based partly on works submitted to publication in peer-reviewed academic journals. Co-authors are listed at the beginning of each empirical chapter (Chapters 4-6) in which they are featured. While co-authors are those that contributed intellectually to the presented work, many others also contributed to works presented in this thesis. Anne Perrett, Kate Epstein, and Iris Holzleitner provided assistance in proof reading. Daniel Menendez, Charlotte Poynton, Stephanie Belenkov, Louise Milligan, Emma Martin, Rebecca Munns, Natalia Fedorova, and Olivia Ives assisted in face delineation and data collection. Dengke Xiao provided the experimental interface for face rating tasks and cognitive ability tests, as well as the interface used to objectively measure facial cues.

Acknowledgments

This PhD is far from my own work. I could not have summoned the effort, motivation, or intellectual curiosity the project required alone. Indeed, left to myself, I can be unmotivated and overwhelmed by my scattered curiosities. My intellectual ability is unreliable, to say the least.

Then, for instilling in me the necessary attributes the project required, I give thanks to my Grandmother Nati Talamas and Uncle Joe Talamas for their mentorship and guidance. Words will never be able to express my gratitude. Any and all good I have ever done, or will ever do, I owe to lessons they imparted to me. My passion for teaching and learning is undeniably inspired by their encouragement and the passion both of them have for these pursuits.

The US Military (TACP community) developed in me some of the qualities and provided the funding needed to complete this PhD. Indeed the military made starting the PhD possible ï I thank TACP leadership for letting me pursue my education while deployed and a Masters afterward, rather than another deployment.

Thank you to the University of St Andrews rowing and basketball team for assistance with participant recruitment ï cheers for not blocking me on Facebook after the first (and second) request. A special shout out to the basketball team for consistently dragging me out of the office to train, play, or coach. Messing about with you guys kept me sane. Many thanks to Chris P, Andreas P, and Dan K, for their reliable assistance off court, which was always better than my assists on court.

I am particularly indebted to the Perception Lab for providing feedback on my research ideas, concerns, posters, manuscripts, and presentations, taking care of Willypete (and getting full of his hair), and for putting up with my often-immature humor. The diverse group of individuals at the Perception Lab offered me additional outlets for this humor and other means of staying sane during the process: Audreyôs Cards Against Humanity skills have made me feel less guilty about my own inappropriate humor; Jingôs dance skills have emphasized the importance of a work-life balance; Marthaôs neon posters have prompted my life-planning skills; Stephôs willingness to attend to Carlotta has encouraged my patience; and Carlottaôs gossiping skills have resulted in surprisingly decent advice on multiple occasions. Thank you also to Lotty, a wannabe perception lab member/wife who, like the rest of the perception lab, has always had my back. Honestly, you all are amazing ï thank you so much for everything.

A special shout-out to Iris who took a considerable amount of time out of her PhD work to help get me settled into the lab on my first dayé and every day after that for the next two years. A big thanks to the various past Perception Lab members like Ross W, Amanda H, Lisa D, Ben J, Tony L, and Ian P, for conversations that sparked ideas for improved and new research. Also, thank you Lesley for your unfailing administrative support, Dengke for assistance with multiple technical queries, and Anne, for proof reading, which has made me a better writer.

To my second supervisor (my only supervisor with natural-colored hair) Martin Campbell for providing constructive feedback on all my work in an impressively timely and reliable fashion and my co-supervisor Ken Mavor for invaluable contributions to manuscripts and to my understanding of statistics.

To my boy Willypete (A.K.A. William Peter) for his assistance with participant (and friend) recruitment. I have benefited from your St. Andrews fame and appreciate your moral support throughout.

Finally, I will be forever appreciative of my supervisor, Dave Perrett. Daveôs mentorship far surpassed his role as a supervisor: his daily support was unmatched, his patience was extraordinary, his passion for research was contagious, and his concern for my work-life balance was sobering. Thank you, Dave.

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Thesis Abstract

Perceptions of intelligence are strongly related to attractiveness and have a significant impact on first impressions. The introductory chapters (1 ï 3) provide an overview of the literature on attractiveness, halo effects, and intelligence, while the experimental chapters (4 ï 6) explore perceptions of cues to intelligence beyond attractiveness, individual differences in the susceptibility to the halo, and the accuracy of perceptions of competence.

Chapter 4 investigated the malleable facial cues of eyelid-openness and mouth curvature and their influence on perceived intelligence. Attractiveness partially mediated intelligence impression, but effects of eyelid-openness and subtle smiling enhanced intelligence ratings independent of attractiveness. These effects were observed and replicated in between individual (cross-sectional) studies of natural images of adult faces, child faces, through digital manipulation of individual cues in the same faces, and in a within individual sleep-restricted sample. Chapter 5 investigated the relationship between perceived intelligence and attractiveness by exploring whether a ratersôown intelligence may be related to a stronger endorsement of the perceived intelligence-attractiveness halo. The correlation between ratings of the perceived intelligence and attractiveness was found to be stronger for participants who scored higher on an intelligence test than participants with lower intelligence test scores. Chapter 6 investigated the limiting effects of attractiveness on perceptions of competence. When statistically controlling for the attractiveness halo, academic performance could be predicted from judgments of conscientiousness but not from ratings of intelligence.

Thus this thesis demonstrates that malleable facial cues can influence perceptions of intelligence independent of attractiveness, identifies an individual difference that influences endorsement of the intelligence-attractiveness halo, and shows the limiting effects of the attractiveness halo on potentially accurate perceptions of academic performance. Collectively these findings provide evidence of the powerful influence of attractiveness on perceptions of intelligence; such work is necessary if we are to mitigate such bias.

Overview of Introductory Chapters

The focus of this thesis will be on perceptions of intelligence. It will take into account the robust influence of facial attractiveness. The introductory chapters (Chapters 1 ï 3) discuss relevant literature on facial attractiveness, theories of intelligence, and the halo effect. These chapters will provide a broad overview, while the introduction to the experimental chapters (Chapters 4 ï 6) will provide literature more specific to the research questions investigated.

Chapter 1 summarizes literature on fixed and more changeable cues to facial attractiveness, including facial symmetry, averageness, sexual dimorphism, skin condition, and adiposity. Given the strong inter-correlations between attractiveness, health, and intelligence (arguably related to a general ñfitness factorò), it is likely that the cues discussed could influence perceived intelligence in a similar way to their influence on perceived attractiveness. Chapter 4 investigates the role of additional malleable facial cues that may influence perceived intelligence and attractiveness given their relationship to alertness and perceived health.

Chapter 2 considers the different theories and definitions of intelligence and provides a brief overview of the relationship between intelligence and resource acquisition, mate selection, and academic achievement. Research shows academic performance correlates strongly with intelligence and even more strongly with personality. Thus, Chapter 6 explores whether perceptions of conscientiousness (rather than perceived intelligence specifically) will improve accuracy of perceived academic performance when controlling for an attractiveness bias.

Chapter 3 further explores the relationship between perceived intelligence and attractiveness by scrutinizing expectancy and general halo effects. Chapter 5 explores whether individual differences in intelligence affect the endorsement of the perceived intelligence-attractiveness halo.

Chapter 1: What Is Attractiveness?

1. Attractiveness

Physical attractiveness has long been associated with a favorable bias. Dion, Berscheid, and Walster (1972) claimed that ñwhat is beautiful is goodò (p.285). Since that time, research has consistently shown that physical attractiveness has a halo effect, leading to consistent, but not necessarily accurate, positive personal quality judgments of physically attractive people. This chapter identifies the facial cues that people consider to be attractive.

Tradition holds that beauty is in the eye of the beholder. Some research supports this claim, finding that differences in the beholder (discussed more in Chapter 3) include hormones (DeBruine, Jones, & Perrett, 2005; Jones et al., 2008; Penton-Voak et al., 1999; Penton-Voak & Perrett, 2000), personality (Little, Burt, & Perrett, 2006), and self-evaluation (Kandrik & DeBruine, 2012; Little, Burt, Penton-Voak, & Perrett, 2001), all of which are just some individual differences that can influence mate preferences (see Germine et al., 2015; Perrett, 2010). Despite these differences in views on beauty, research has also found a surprising degree of agreement regarding facial attractiveness. Specifically, cross-cultural studies have found high levels of agreement on facial attractiveness across different countries (Langlois et al., 2000; Swami, Knight, Tovée, Davies, & Furnham, 2007; Swami & Tovée, 2005; Tovée, Swami, Furnham, & Mangalparsad, 2006) and across gender (Rhodes, 2006).

It is possible that agreement over facial attractiveness stems from cues to attractiveness that are related to actual health. In a comprehensive review on the evolutionary psychology of facial beauty, Rhodes (2006) discusses a ñgood genesò theory of mate selection, which argues that the fixed facial cues of averageness, symmetry, and sexual dimorphism are all good candidates for biologically based standards of beauty, given their relation to health (Fink & Penton-Voak, 2002; Grammer, Fink, Möller, & Thornhill, 2003; Johnston & Franklin, 1993; Scheib, Gangestad, & Thornhill, 1999; Thornhill & Gangestad, 1993). More recently, research has explored the influence of the malleable facial cues of skin condition and adiposity in relation to attractiveness and actual health (Coetzee, Chen, Perrett, & Stephen, 2010; Coetzee, Perrett, & Stephen, 2009; Rantala et al., 2013; Stephen, Coetzee, Law Smith, & Perrett, 2009; Stephen, Coetzee, &

Perrett, 2011). Measurement of these cues is of particular importance given the subtlety of cues like symmetry and their relationship to perceived and actual attributes. Building on this research, this chapter discusses the fixed facial cues of symmetry, averageness, and sexual dimorphism, as well as malleable cues of skin condition and adiposity and their relationship to attractiveness and health.

Stereotypes and overgeneralizations are likely to influence impression formation. For instance, the perception of individuals with droopy eyelids as tired and unintelligent may be an overgeneralized response based on the well-known relationship between sleep and decreased cognitive performance (Pilcher & Huffcutt, 1996; Thomas et al., 2000). An overview of stereotypes, the overgeneralization effect, and valid trait attributions from faces serves as an introduction to the new malleable cues (eyelid-openness and mouth curvature) that are investigated in relation to perceived intelligence in Chapter 4.

1.1 Symmetry

Research suggests that symmetry is a signal of high-quality genes and relative disease resistance (Perrett et al., 1999; Rhodes et al., 2001; Scheib et al., 1999; Thornhill & Gangestad, 1993). The methods used to measure the effects of symmetry are particularly important, given that the differences in methods has led to differences in findings (these methods are also important when considering the cues investigated in Chapter 4). Earlier studies on facial symmetry assessed preferences for symmetry by producing chimeras, which are made by taking one vertical half of a face and mirroring it (split by a vertical midline) to create the other half (Kowner, 1996; Samuels, Butterworth, Roberts, Graupner, & Hole, 1994). This method can produce symmetric, but distorted faces with non-average features which were found to be less attractive than asymmetric faces (Perrett et al., 1999).

Studies of un-manipulated faces have found that participants consider fluctuating asymmetries (FAs) unattractive. While directional asymmetries, like the mammalian heart for example, reflect a systematic difference in one side of a symmetrical plane, FAs are random deviations from symmetry that have been associated with challenges to fetal growth during pregnancy (Blount et al., 1997), or early post-birth development (e.g., exposures to toxins or high levels of stress; Thornhill & Gangestad, 1996, 1999). Humans, as well as other species, are able to detect small FAs, without any training (Palmer &

Strobecke, 2015). In turn, measures of symmetry have shown to correlate with facial attractiveness (Jones, DeBruine, & Little, 2007; Penton-Voak et al., 2001; Perrett et al., 1999).

Several studies have suggested a relationship between symmetry and health, whether self-reported (Thornhill & Gangestad, 2006) or actual (Jones et al., 2004; Rhodes et al., 2001). FAs increase with age (Wilson & Manning, 1996) and have shown to correlate with heavier body weight (Manning, 1995), predisposition to breast cancer (Manning, Scutt, Whitehouse, & Leinster, 1997), slower running speed (Manning & Pickup, 1998), and higher metabolic rate (Manning, Koukourakis, & Brodie, 1997).

Similarly, studies have consistently shown a relationship between FAs and intelligence (Bates, 2007; Furlow, Armijo-Prewitt, Gangestad, & Thornhill, 1997; Luxen & Buunk, 2006; Penke et al., 2009). A meta-analysis by Banks, Batchelor, and McDaniel (2010) based on 14 samples across 1871 people found that people who score higher on intelligence tests are significantly more symmetrical, although this correlation is weak (i.e., effect size is small).

The relationship between intelligence and symmetry is one indicator of a ñgeneral fitness factorò, in which multiple cues are convergent indicators of survival and reproductive success (Furlow et al., 1997; Miller, 2000; Möller & Alatalo, 1999; Prokosch, Coss, Scheib, & Blozis, 2009; Prokosch, Yeo, & Miller, 2005; Singh, 1995). Intelligence has also been shown to correlate with physical health (Arden, Gottfredson, & Miller, 2009; Batty, Deary, & Gottfredson, 2007; Gottfredson & Deary, 2004; but see Pound et al., 2014), semen quality (Arden, Gottfredson, Miller, & Pierce, 2009), and life expectancy (Jokela, Batty, Deary, Gale, & Kivimäki, 2009). Hence, the relationship between intelligence and a general ñfitness factorò highlights the potential for visible cues to intelligence to be perceived as attractive (Moore, Filippou, & Perrett, 2011).

In support of facial symmetry being related to gene quality and attractiveness, Little, Burt, Penton-Voak, and Perrett (2001) found that women who rated themselves as attractive preferred symmetrical male faces, while women who rated themselves as average or below average had lower standards for symmetrical faces in males. Additionally, Little and Jones (2012) found that women in different phases of their menstrual cycles have different preferences for symmetry. Specifically, women were found to prefer symmetry in the follicular phase of their cycle when fertility is likely to be highest compared to the luteal (premenstrual) phase (Little & Jones, 2012). This effect was observed when rating faces for short-term relationship attractiveness, but no influence of cycle was seen for long-term judgments, consistent with previous literature on mate preferences across the ovulatory cycle (Gildersleeve et al., 2013; Gildersleeve, Haselton, & Fales, 2014). Collectively, stronger preferences for symmetry by attractive and fertile women provides support for symmetry being a signal for genetic quality and being a desired trait.

1.2 Averageness

Research on facial averaging has come a long way from when Galton (1878) first noted that a composite of faces is better looking than individual faces. Several methods of measuring and assessing the attractiveness of averaged faces have developed since Galtonǿs initial observation. While Langlois and Roggman (1990) computed mathematical averages of digital images and argued that averaged faces were more attractive because they are more similar to the average value of the population, these methods and theories have advanced since then.

Researchers criticizing studies involving computer-generated average faces have argued that participants respond favorably to homogenous skin texture and symmetry rather than averageness itself (Alley & Cunningham, 1991; Benson & Perrett, 1992; Tiddeman, Burt, & Perrett, 2001). Yet, while Grammer and Thornhill (1994) found that averaged faces were not attractive when statistically controlling for the influence of symmetry, research by Rhodes, Sumich, and Byatt (1999) found that actually symmetrical faces became more attractive when averageness was increased. Additionally, more recent research by Jones, Debruine, and Little (2007) found average faces were more attractive than less average faces when symmetry was digitally controlled for in composite faces.

The attractiveness of averageness has important caveats. Averageness is attractive within categories like age, sex, and race (Bestelmeyer et al., 2008; Little, DeBruine, Jones, & Waitt, 2008), but averages made *between* categories are not necessarily more attractive. For example, an average of women and men may look less attractive than an average of just women because femininity is attractive in womenǿs faces (Perrett et al., 1998). Averaging also has limitations with respect to more attractive faces (DeBruine, Jones, Unger, Little, & Feinberg, 2007). A set of faces deemed attractive will produce a more attractive average by itself than the average of a larger set of faces that includes all of the attractive faces and a set of less attractive faces (Perrett, May, & Yoshikawa, 1994).

The notion that an average face is more attractive than a unique face may run contrary to popular belief. Yet, it can be argued that unique faces are categorized as unusual, different, or weird which may be subtly related to illness or developmental abnormalities. Correspondingly, averageness in faces can hint at probable good health, much like symmetry does. Theory would suggest that traits that advertise resistance to parasites (e.g., bacteria and viruses) are preferred (Grammer & Thornhill, 1994; Hamilton & Zuk, 1982). Indeed, research has found that both facial averageness and symmetry were perceived as healthier (Fink, Neave, Manning, & Grammer, 2006; Jones, Little, Feinberg, et al., 2004; Rhodes et al., 2001) and correlated positively with childhood health (based on detailed medical records; Rhodes et al., 2001). In summary, facial averageness is a fixed cue to attractiveness, independent of symmetry, and has been shown to be related to both perceived and actual health.

1.3 Sexual Dimorphism

Facial sexual dimorphism, or sex typicality, refers to the masculinity or femininity of a face. Estrogen is largely related to feminine facial features, while androgens such as testosterone govern the development of masculine facial features (Fink & Penton-Voak, 2002; Law Smith et al., 2006; Miller & Todd, 1998). Males and females show significant differences in overall face size, eyebrow ridges, and jawbone size, with women having less prominent eyebrow ridges and a smaller chin compared to men (Enlow & Hans, 1996; Weston, Friday, & Liò, 2007).

Some research has found that women preferred feminized male faces (Little & Hancock, 2002; Perrett et al., 1998), while other researchers have found a preference for masculinized male faces (Cunningham, Barbee, & Pike, 1990; Grammer & Thornhill, 1994; Scheib et al., 1999). Women prefer more masculine faces in a short-term relationship context and more feminine faces in a long-term relationship context (Conway, Jones, DeBruine, & Little, 2010; Little, Cohen, Jones, & Belsky, 2007). Research also suggests womenȇs preferences for masculinity can change according to their menstrual cycle, with a higher preference for masculinity in the fertile phase and a higher preference for femininity during the non-fertile phase (Jones et al., 2008; Little & Jones, 2012; Penton-Voak & Perrett, 2000; Penton-Voak et al., 1999). Indeed, differences in culture (Penton-Voak, Jacobson, & Trivers, 2004), pathogen disgust (DeBruine, Jones, Tybur, Lieberman, & Griskevicius, 2010), and access to medical care (DeBruine, Jones, Crawford, Welling, & Little, 2010; Penton-Voak et al., 2004) can also influence preference for masculinity. In turn, these findings suggest female perceptions of masculinity are complex and many variables should be considered when referring to the attractiveness of masculinity.

Within female faces, there is general agreement that femininity (Jones et al., 1995; Perrett et al., 1998) is attractive, which is consistent with findings that female facial femininity correlates with youthfulness (Jones et al., 1995), reproductive hormone levels (Law Smith et al., 2006) and maternal tendencies (Law Smith et al., 2012).

Measurements of masculinity, like other facial cues discussed previously, have been widely disputed in the literature. While some researchers argue that simply asking individuals to rate perceived masculinity is enough to capture differences in sexual dimorphism as perceived by raters (e.g., Rhodes, 2006) others have contended that perceptual ratings of masculinity can be confounded by other parameters (i.e., facial averageness and/or symmetry), as well as sexual stereotypes of sex-specific personality traits. In light of this, many researchers advocate using morphological measures of masculinity (Komori, Kawamura, & Ishihara, 2011). While perceived masculinity is linked to perceived attractiveness (Koehler, Simmons, Rhodes, & Peters, 2004; Rhodes et al., 2007; Rhodes, Simmons, & Peters, 2005), other studies that use morphological measurements of masculinity instead, fail to replicate a relationship between masculinity and attractiveness (Koehler et al., 2004; Penton-Voak et al., 2001; Stephen et al., 2012; Thornhill & Gangestad, 2006; Waynforth, Delwadia, & Camm, 2005). The differences in findings for perceived and measured facial cues are noteworthy, and will be further investigated in the context of eyelid-openness and ñneutralò mouth curvature in Chapter 4.

In keeping with the relationship between testosterone and facial masculinity, both perceived and measured aspects of facial masculinity have been shown to correlate with handgrip strength (Fink, Neave, & Seydel, 2007; Windhager, Schaefer, & Fink, 2011) and testosterone (Lefevre, Lewis, Perrett, & Penke, 2013; Penton-Voak & Chen, 2004; Roney, Hanson, Durante, & Maestripieri, 2006). While some studies have suggested facial masculinity is associated with *actual* aggression (Carré & McCormick, 2008) and *actual* dominance (Haselhuhn & Wong, 2012; Lewis, Lefevre, & Bates, 2012; Stirrat & Perrett, 2010), more recent studies with larger samples have failed to replicate findings (Gómez-Valdés et al., 2013; Lefevre et al., 2012; Özener, 2012). Nonetheless, individuals usually *perceive* masculine faces as aggressive and dominant (Alrajih & Ward, 2013; Carré, McCormick, & Mondloch, 2009; Carré, Morrissey, Mondloch, & McCormick, 2010; Geniole, Keyes, Mondloch, Carré, & McCormick, 2012; Short et al., 2012). Perrett et al. (1998) also found that masculinized faces were rated as less kind, less emotional, colder, less honest, less cooperative, and less likely to be a good parent, while feminized faces were rated in an opposite manner.

The relationship between masculinity and health has been controversial. Numerous studies have found a relationship between masculinity and *perceived* health (Boothroyd, Scott, Gray, Coombes, & Pound, 2013; Johnston, Hagel, Franklin, Fink, & Grammer, 2001; Rhodes, Chan, Zebrowitz, & Simmons, 2003; Rhodes, 2006; Scott, Swami, Josephson, & Penton-Voak, 2008; Smith, Jones, Debruine, & Little, 2009; Zebrowitz & Rhodes, 2004), yet studies investigating the relationship between masculinity and *actual* health are inconclusive (Boothroyd et al., 2013; Rhodes et al., 2003; Roberts, Buchanan, & Evans, 2004; Scott, Clark, Boothroyd, & Penton-Voak, 2013). The relationship between masculinity and health has been debated (for discussion see Boothroyd et al., 2013; Rantala et al., 2013; Scott et al., 2013), but these debates go beyond the scope of this thesis. More pertinently, the relationship between facial masculinity and attractiveness is complex given the simultaneous links of masculinity to negative personality attributions, but potentially positive health attributions.

1.4 Skin Condition

Several studies have found a relationship between skin condition (skin texture and skin color) and perceived attractiveness. People typically prefer skin that is free from lesions and atypical growths (Symons, 1995). Further, people typically perceive evenness in skin texture (Fink, Grammer, & Thornhill, 2001) and skin color (Fink, Grammer, & Matts, 2006; Matts, Fink, Grammer, & Burquest, 2007) as younger, healthier, and more attractive. Additionally, research has found that skin patches (on cheeks) from symmetrical faces were perceived as more healthy than skin patches from asymmetric faces (Jones, Little, Burt, & Perrett, 2004). The same study showed that digitally putting skin texture that had previously been rated as healthy onto other faces made those faces appear more attractive than faces with unhealthy rated skin texture superimposed onto them (Jones et al., 2004).

Skin condition is related to health, and the skin attributes that people find attractive correlate with good health. Jones et al. (2004) argue that perceptions of health mediate the relationship between skin color and attractiveness, such that skin color affects facial attractiveness through the influence of color on perceived health.

Research indicates that when participants are asked to manipulate face color to optimize perceived health, participants increase skin redness, yellowness, and lightness (Stephen, Coetzee, et al., 2009; Stephen, Law Smith, Stirrat, & Perrett, 2009). These three dimensions of skin color preference may each reflect different aspects of health. More skin redness indicates oxygenated blood levels that increase with respiratory health (Armstrong & Welsman, 2001) and decrease with cardiac and respiratory illness (Ponsonby, Dwyer, & Couper, 1997). Similarly, more skin yellowness correlates with higher carotenoid consumption (Edwards & Duntley, 1939; Stamatas, Zmudzka, Kollias, & Beer, 2004; von Schantz, Bensch, Grahn, Hasselquist, & Wittzell, 1999). Carotenoids are antioxidants obtained in diet (through fruits and vegetables) and expended in immune defense (Alaluf, Heinrich, Stahl, Tronnier, & Wiseman, 2002; Friis et al., 2001). Hence, high skin yellowness may signal a healthy state and a good diet (Stephen, Coetzee, et al., 2009; Stephen, Law Smith, et al., 2009). Skin lightness is mainly influenced by melanin, with higher melanin making skin darker (and also more yellow). While some melanin is healthy, as it has been shown to prevent skin cancer and sunburn (Robins, 1991), as well as fetal development defects (Omaye, 1993), too much melanin can inhibit vitamin D synthesis and thus have negative effects on health. In summary, there is a growing realization that the malleable facial cue of skin color plays a large role in perceived health and attractiveness, a role that is greater than fixed facial traits such as sexual dimorphism (Scott et al., 2013; Stephen et al., 2012).

1.5 Facial Adiposity

Perceptions of adiposity, the perception of weight in the face (Coetzee et al., 2009), show a connection between perceived attractiveness and health similar to that of facial symmetry, averageness, sexual dimorphism, and skin condition. Yet, like skin condition, but unlike facial symmetry, averageness, and sexual dimorphism, adiposity can change over a fairly short time scale.

The relationship between adiposity, health, and attractiveness is also similar to the relationship between body mass index (BMI), attractiveness of body shape (Parkinson, Tovée, & Cohen-Tovee, 1998; Swami et al., 2007; Swami & Tovée, 2005; Tovée, Reinhardt, Emery, & Cornelissen, 1998), and health (Flegal, Graubard, Williamson, & Gail, 2005; Manson et al., 1995; Mokdad et al., 2003; Must et al., 1999; Pi-Sunyer, 1993; Ritz & Gardner, 2006; Wilson, DôAgostino, Sullivan, Parise, & Kannel, 2002). Specifically, the relationship between BMI and health is curvilinear, with both very high and very low BMI being unhealthy, which matches the curvilinear relationship between BMI and perceived attractiveness of body shape (i.e., very high and very low BMI is unattractive; Furnham & Baguma, 1994; Maisey, Vale, Cornelissen, & Tovée, 1999; Tovée et al., 1998). Indeed, Coetzee et al., (2009) find a similar curvilinear relationship between perceived adiposity and perceived health and attractiveness.

There has been a growing amount of research suggesting a relationship between perceived adiposity and actual health. Research has found that adiposity was a significant predictor of actual health measured by respiratory infections, use of antibiotics, and blood pressure (Coetzee et al., 2009). Additionally, research has found a relationship between perceived weight and a composite measure of physical and psychological health (Tinlin et al., 2013). In men, adiposity has also been linked to an antibody response to the hepatitis B vaccination and was shown to mediate the relationship between antibody response and perceived attractiveness (Rantala et al., 2013).

1.6 Interacting Cues

All in all, there are multiple facial cues to attractiveness and health, some of which change slowly over time depending on maturity (masculinity) or developmental stability (averageness and symmetry), while others change on a quicker time scale according to diet and exercise (skin condition and adiposity). There is increasing evidence that the importance of malleable cues compared to fixed traits in attractiveness has been underestimated.

In general, separate cues to attractiveness covary, such that male facial masculinity and male facial symmetry are positively associated (Little, Jones, et al., 2008), and high facial symmetry is associated with an attractive skin appearance (Jones, Little, Burt, & Perrett, 2004). The positive correlations amongst attractiveness cues provide further evidence for a general ñfitness factorò (Candolin, 2003; Feinberg et al., 2005; Thornhill & Grammer, 1999).

The interaction amongst facial cues is also noteworthy. Some have argued that adiposity is a more significant predictor of health (measured by hepatitis B antibody response) than masculinity (Rantala et al., 2013). Fisher, Han, DeBruine, and Jones (2014) found a significant interaction between adiposity and color cues, such that low adiposity was perceived as more attractive and healthy for faces with increased skin redness and yellowness (healthy-looking coloration); whereas adiposity had less of an impact on ratings of unhealthily colored faces. Stephen (2012) found that facial skin color is a better predictor of attractiveness than facial masculinity. These findings are consistent with findings from Stephen et al. (2012) suggesting that ñstateò cues, which are cues related to current or recent health, are more important predictors of attractiveness than ñtraitò cues, which are more structural cues to past health during development. In turn, it seems that perceptions of attractiveness and perceived health are complex, in that they reflect and perhaps overgeneralize from cues to current and previous health.

1.7 Stereotypes and Overgeneralizations

The tendency to judge others by their facial appearance and the consensus shown in such judgments is noteworthy and begs the question of the origins of such impression formation. The literature on stereotypes provides some insight on consensus among judgments of facial stimuli. While literature on stereotypes is varied, researchers tend to share the perspective that stereotypes are related to three underlying principles: stereotypes are aids to explanation, stereotypes are energy-saving devices, and stereotypes are shared group beliefs (Devine, 1989; McGarty, Yzerbyt, & Spears, 2002). Thus, the tendency to use stereotypes when making judgments on facial appearance seems appropriate in ñaiding explanationò when no other information about the target is available. Early research on stereotypes by Katz and Braly (1935) defined stereotypes as ñfixed impressions which conform very little to the facts it pretends to representò (p. 181). Yet, more recent definitions of stereotypes have highlighted that stereotypes need not be accurate or negative and that stereotypes are beliefs about the characteristics or attributes of a group (Judd & Park, 1993). For example, one may hold the stereotype that attractive people are more healthy than unattractive people.

Overgeneralizations can be seen as using stereotypes (e.g., attractive people are healthier) to form impressions or guide perceptions. Specifically, overgeneralization can be defined as a logical fallacy that occurs when a conclusion about a group is drawn from an unrepresenative (too small or narrow) sample (Walton, 1999). Thus, overgenerlizations, like stereotypes, need not be accurate, but given the nature of drawing conclusions from unrepresenative samples, they probably are inaccurate. Zebrowitz, Fellous, Mignault, and Andreoletti (2003) argued that overgeneralizations involve accurate trait impressions in certain faces (a small unrepresentative sample) being overgeneralized to other faces that are similar to the unrepresentative sample. Zebrowitz et al. (2003) extend the overgeneralization hypothesis to the anomalous face overgeneralization in which faces resembling those that are ñunfitò illicit negative responses. For example, the perception of normal individuals with uneven and pale skin color as unattractive and unhealthy may be an overgeneralized response based on an adaptation to avoid illness or contagion, as some individuals who show marked skin paleness and unevenness are, in fact, unhealthy (Stephen, Coetzee, et al., 2009). Arguably, such overgeneralizations could be seen as maladaptive, given that they lead individuals to reject healthy and fertile, yet unattractive, individuals as mates. On the other hand, ecological theory suggests that the cost associated with failure to avoid such ill health information can be more maladaptive than missing healthy and fertile mates (Zebrowitz et al., 2003).

When discussing overgeneralizations, the issue of accuracy comes into play, for overgeneralizations typically stem from a belief, which by nature, is thought to be accurate (at least by the perceiver). A thorough review by Todorov et al. (2015) highlights several factors that emphasize the overstated accuracy of trait attributions from faces alone. In particular, research has found that failing to properly control for obvious indicators of the traits being deduced (i.e., targetôs gender, age, and ethnicity) may result in an overestimation of how much information is accurately being inferred from the face alone (Olivola, Eubanks, & Lovelace, 2014; Olivola, Sussman, Tsetsos, Kang, & Todorov, 2012). For instance, amongst children and adolescents, those with older looking faces are likely to be perceived as more intelligent, which is congruent with increases in actual crystalized intelligence with age (discussed more in Chapter 2). Another factor that may influence the overestimation of accuracy in attributions from faces is the significant differences in images of the same person taken on different occasions (Todorov & Porter, 2014). For example, a person with a subtle smile may be perceived as more extroverted, but an image of the same person with a subtle frown might result in different perceptions of personality and perhaps different accuracy in perceived personality.

Subtle smiling, sometimes referred to as positive emotional valence, has been shown to have a marked influence on impression formation. From behavioral studies and computer modeling, Oosterholf and Todorov (2008) introduced a two-dimensional model demonstrating an underlying structure for face evaluations based on two primary dimensions: trustworthiness or valence and dominance. That is, while many attributions (intelligence, trustworthiness, extraversion, neuroticism, agreeableness, etc.) can be made to faces, all of these attributions can be accounted for by just differing amounts of the two dimensions. While Todorov and colleagues (2008) worked with faces with supposedly neutral expressions, subtle shape differences in mouth curvature reminiscent of smiling and frowning exerted a profound influence on impression of trustworthiness. Findings suggest that judgments of trustworthiness stem from an overgeneralization made to emotional expressions that may signal hostile or friendly intentions, which can be related to whether the person should be avoided or approached. Specifically, the valence dimension accounted for most of the variance in a variety of trait judgments (63.3%) which were mainly related to positive judgments such as whether a face is perceived as attractive or responsible. On the other hand, the dominance dimension is more sensitive to features signaling physical strength (e.g., masculinity and maturity of age) and related to judgments such as aggressiveness and confidence. Sutherland et al. (2013) replicated the two-dimensional valence/trustworthiness by dominance model of social inferences and added a new ñyouthful-attractivenessò factor. Researchers reasoned that the emergence of the new ñyouthful-attractivenessò dimension was related to differences in a more realistic set of stimuli used, yet it could also be argued that such unstandardized stimuli (e.g., overt expressions, dramatic differences in head posture, etc.) may confuse interpretations.

The dimensions of dominance and trustworthiness/valence are particularly interesting considering their relatedness to fixed (or static) and malleable (or dynamic) cues to trait attributions. Hehman, Flake, and Freeman (2015) discuss the differences in the influence of static and dynamic facial cues on the attributions related to dimensions of trustworthiness/valence and dominance. Specifically, Hehman et al. (2015) argue that dynamic facial cues are more likely to influence judgments of intentions (trustworthiness/valence dimension), while evaluations of ability (dominance/physical ability dimension) are more likely to rely on static facial cues. For example, the degree to which a person is smiling and has eyes wide open can change quickly and in turn influences their perceived mood or tiredness accordingly. Similarly, an overgeneralization effect may result from subtle cues to tiredness influencing perceptions of intelligence, given the well-known relationship between tiredness and reduced cognitive ability (Ohayon & Vecchierini, 2005; Pilcher & Huffcutt, 1996; Wickens, Hutchins, Laux, & Sebok, 2015). Chapter 4 investigates the potential for dynamic cues of mouth curvature and eyelid-openness to influence perceptions of intelligence accordingly.

1.8 Summary

Various studies have investigated facial cues and their influence on attractiveness and other personality trait attributions. It is clear that facial symmetry, averageness, sexual dimorphism, skin color, and adiposity all have at least some biological basis. These facial cues seem to offer a potential basis for some accuracy in attributions to the actual state of a personôs health and fitness, testosterone level, blood perfusion and oxygenation state, carotenoid levels, and BMI, yet people overgeneralize these facial cues to guide their social attributions of personality, strength, aggression, and health. Literature suggests these perceptions all seem to be related to two underlying dimensions: trustworthiness/valence and dominance (Oosterhof & Todorov, 2008), which are of particular importance when exploring the role of fixed and malleable facial cues on social judgments (Hehman et al., 2015).

The different methods used to measure the facial cues discussed have all improved to some extent over time, based on emerging evidence and technological advancements. Yet, different methods have often resulted in different, and at times, conflicting findings and interpretations; it is important, therefore, to advance methodological approaches to understand the role of certain facial cues on first impressions.

In an attempt to offer a novel measurement of malleable facial cues that may have been underestimated, Chapter 4 explores the role of eyelid-openness and mouth curvature on impressions of attractiveness and intelligence. Specifically, we created new measurements that can detect slight differences in eyelid-openness and mouth curvature in facial images and validated these measurements with perceptual judgments from raters. Through mediation analysis we investigated the role of these malleable cues on perceptions of intelligence, independent of attractiveness. In a similar manner to the other cues discussed thus far, Chapter 4 discusses the potential validity of cues of eyelid-openness and mouth curvature by reviewing their relationship to actual sleep deprivation, and thus exploring the overgeneralizations that may follow.

Chapter 2: What Is Intelligence?

2. Intelligence

Beliefs about intelligence influence an evaluatorôs perceptions of what makes a face intelligent looking. This chapter focuses on how varying perspectives and understandings of the effects of intelligence on life outcomes (i.e., mate selection and academic performance) may influence accurate perceptions of competence, while Chapter 3 will go on to discuss how individual differences may influence the extent to which an individual endorses the perceived intelligence-attractiveness relationship.

The Merriam-Webster dictionary defines intelligence as ñthe ability to learn or understand things or deal with new or difficult situationsò(ñIntelligence,ò 2016), yet theories and definitions of intelligence differ, and the nature of intelligence is arguably one of the most controversial topics in psychology, in large part due to its debated relationship to socioeconomic status (Capron & Duyme, 1989; Jencks, 1972; Mackintosh, 1998) and ethnicity (Loehlin, 1974; Mackintosh, 1998; Rushton & Jensen, 2005). This thesis mitigates the problem of in-group favoritism (Zebrowitz, Bronstad, & Lee, 2007) by examining perceptions of Caucasian faces by Caucasian evaluators exclusively. Yet, different views on definitions and supposed outcomes of intelligence may still sway the degree to which competence is perceived accurately.

After broadly discussing theories and definitions of intelligence, this chapter will discuss potential consequences of intelligence such as resource acquisition, mate selection, and academic performance. Theories and outcomes of intelligence serve as an overview primarily for Chapter 6, which investigates whether individuals can accurately assess academic performance from faces alone when controlling for the well-documented attractiveness halo (discussed more in Chapter 3) and examines the differences in accuracy amongst different perceived competence measures.

2.1 Theories of Intelligence

An individualôs óimplicit theory of intelligenceô refers to an individualôs fundamental underlying beliefs about whether intelligence or abilities can change or are static (Dweck, Chiu, & Hong, 1995; Dweck & Henderson, 1989). Individuals who believe intelligence and ability are fixed and unchangeable subscribe to the óentityô mindset (sometimes referred to as a fixed mindset), while an individual who believes hard work and effort influences intelligence has an óincrementalô mindset (sometimes referred to as a growth mindset). These implicit theories influence behavior; individuals who subscribe to incremental theory perform better academically (Blackwell, Trzesniewski, & Dweck, 2007) and have stronger negotiating skills (Kray & Haselhuhn, 2007). Thus far, research on implicit theories of intelligence has focused on impacts on goal orientation and motivation. Yet, there are reasons to believe that implicit theories of intelligence could also impact upon perceptions of other peopleôs intelligence, for example they may alter the accuracy of judgements of the intelligence of others.

2.1.1 Multiple intelligences

Individuals (including psychological researchers), differ in their definitions of intelligence. Some researchers have criticized the traditional conception of intelligence, as measured by standardized intelligence tests, by arguing that intelligence tests primarily measure how ñbook smartò an individual is. In turn, various researchers have proposed that there are multiple intelligences (Gardner, 1983, 2000; Sternberg, 1985, 2000). Guilford (1959, 1977) pioneered the concept of separate measures of intelligence, suggesting human mental abilities encompass about 150 different types. Later, Gardner (1983, 2000) suggested that there are eight different types of intelligence: rhythmic, spatial, linguistic, mathematical, kinesthetic, interpersonal, intrapersonal, and naturalistic. Thus, while someone may be musically gifted, they may be less mathematically inclined. Theories of multiple intelligences have inherent appeal in that they imply that everyone is smart at something, even if the traditional intelligence test (e.g., Raven Standard Progressive Matrices, Wechsler Adult Intelligence Test, etc.) does not reflect it. Yet, less empirical evidence supports multiple intelligences theories compared to other theories of intelligence (Carroll, 1993; Gottfredson, 2003).

2.1.2 General factor g

Psychometrics and traditional psychology appreciates Spearmanôs (1905) g factor of general intellectual ability, which is the underlying performance of an individual based on scores on a range of abilities. In essence, Spearmanôs g suggests that different ability tests are significantly intercorrelated; for example, someone who scores high on a verbal test will likely score similarly high on a numerical test.

Spearman (1927) developed a data-reduction procedure called factor analysis that examines the correlations among a series of measures to identify underlying patterns in the data that can be attributed to an unobservable variable (also called a latent variable). Through this method, Spearman (1927) found that performance on various aspects of cognitive ability could be represented by a single general underlying mental ability. Spearman (1927) also developed statistical methods to correct for attenuation as a means to improve measurements of intelligence. This method accounts for measurement error when calculating the correlation between variables. Since cognitive/intelligence tests are not completely accurate in the measure they aim to assess (all tests have a certain level of measurement error), Spearman developed a formula that considers the unreliability of variables being correlated to improve estimates of the relationship between the variables (Spearman, 1927). This method of correcting for attenuation is widely used by psychologists and is used in Chapter 4 and 6 of this thesis.

2.1.3 Fluid and crystalized intelligence

One of Spearmanös PhD students, Cattell (1963), extended Spearmanös (1905, 1927) findings to create the theory of crystallized and fluid intelligence. Using similar factor analysis techniques, Cattell (1963) argued that general intelligence can be categorized into fluid intelligence and crystalized intelligence. Fluid intelligence enables an individual to perform well on nonverbal tasks and other measures of culture-free cognitive performance that do not require previous knowledge. Crystalized intelligence enables an individual to do well on verbal tasks and is substantially influenced by learning and previous knowledge. Chamorro-Prezmuzic (2007) described the difference between fluid and crystalized intelligence using an analogy with computers, saying that fluid intelligence is similar to the processor or hardware of the computer, while crystalized intelligence is more akin to the software on the computer. Testing Cattellös (1963) theory, Horn and Cattell (1967) found that younger adults had higher fluid intelligence while older adults had higher crystallized intelligence, suggesting the negative effects of normal aging on fluid intelligence and the positive effects of additional learning and enculturation on crystalized intelligence. Horn and Cattellös (1967) findings emphasize the importance of breaking down intelligence by suggesting that, depending on what type of intelligence is being measured (fluid or crystalized), intelligence can either increase or decrease with age (p. 124).

There are various measures that assess fluid intelligence in a way that is aimed to be culturally unbiased (Cattell, Feingold, & Sarason, 1941; Cattell, 1940). Some of the most popular, privately owned tests are the Cattell Culture Fair IQ Test, the Ravenœs Progressive Matrices, and the Wechsler Adult Intelligence Test. There are many types of intelligence test items and these have become much more sophisticated over time, with some of the first tests measuring only reaction time to a sound and time for naming colors (Cattell & Galton, 1890). Some of the most common subtests of general intelligence nowadays are: mental rotation tasks which attempt to measure spatial cognition and the rate of processing of spatial information; letter and number series that assess logical reasoning; matrix reasoning items, which assess nonverbal analytical ability; and verbal reasoning, which measures comprehension and critical reasoning (Chamorro-Premuzic, 2007). In the nature of open access science, Condon and Revelle (2014) developed the International Cognitive Ability Resource (ICAR), a 16-item intelligence test and made this resource freely available to researchers interested in measuring intelligence. ICAR is an unproctored and untimed assessment that has been shown to correlate moderately to strongly with other measures of cognitive ability and achievement and is used in Chapter 5. See Appendix 1 for examples on the different types of intelligence test items discussed (i.e., mental rotation, matrix reasoning, letter and number series, and verbal reasoning) and used in Chapter 5.

2.1.4 Defining intelligence

Theories on single general factor intelligence and multiple intelligences may both be correct; that is, they are not mutually exclusive. A single underlying intelligence may lead to strong performance on multiple measures, but these measurements may still represent distinct types of cognitive abilities. Nonetheless, varying perspectives, measurements, and theories of intelligence have led to various definitions of intelligence. In turn, a group of researchers ranging in experience and opinions collaborated on a report (one of the most cited of its kind) entitled ñIntelligence: Knowns and Unknownsò which reviewed approaches to intelligence (Neisser et al., 1996). The following is an excerpt from the report:

ñ*Individuals differ from one another in their ability to understand complex ideas, to adapt effectively to the environment, to learn from experience, to engage in various forms of reasoning, to overcome obstacles by taking thought. Although these individual differences can be substantial, they are never entirely consistent: a given person's intellectual performance will vary on different occasions, in different domains, as judged by different criteria. Concepts of 'intelligence' are attempts to clarify and organize this complex set of phenomena. Although considerable clarity has been achieved in some areas, no such conceptualization has yet answered all the important questions, and none commands universal assent… Indeed, when two dozen prominent theorists were recently asked to define intelligence, they gave two dozen, somewhat different, definitions*ò (Neisser et al., 1996, p. 77).

2.2 Outcomes of Intelligence

Outcomes of intelligence are noteworthy as they shed light on the importance of intelligence, how intelligence is perceived, and why it might be such a sought after trait. In exploring the potential accuracy of competence from faces alone (Chapter 6), it is of particular interest to investigate the extent to which different forms of competence (e.g., physical competence, diligence, etc.) are attractive and the relationship between different assessments of competence (i.e., academic performance, conscientiousness and intelligence).

2.2.1 Mate selection

Intelligence is highly valued, which is not surprising given the clear implications of cognitive ability in everyday life. Indeed, in an analysis of human mate preferences across 37 cultures, intelligence ranked among the top four desired characteristics in potential mates (Buss, 1989). It seems both men and women favor intelligence equally, as Buss (1989) found that men and women only slightly differed in their preferences for intelligence in partners in the context of sexual relations (men had lower acceptable intelligence standards in regards to short-term sexual relationships, but both men and women equally preferred intelligence in a partner to date and marry). As discussed in Chapter 1, intelligence is also related to health which, through a general ñfitness factorò would also explain its relationship to attractiveness. Women may favor traits like physical strength and assess them through indicators like height or face shape (Krams et al., 2014; Sell et al., 2009). Similarly, individuals may favor intelligence as a trait that benefits the acquisition of resources and assess it through traits like alertness, wit, charisma, and imagination (Prokosch et al., 2009). Additionally, personality traits such as conscientiousness may also be a cue to capacity for resource acquisition, since acquisition may also be assessed through traits like hard work and thoroughness (Chamorro-Premuzic, 2006, 2007). Thus, the attractiveness of perceived competence measures, which may signal resource acquisition ability, overlap.

2.2.2 Academic performance

Given that intelligence tests are validated by their ability to predict academic success, it is no surprise that intelligence predicts academic performance (Chamorro-Premuzic, 2007). As such, an intelligence test that did not correlate with achievement at school probably would not be labeled as an intelligence test. While intelligence is a strong predictor of academic performance, other variables, like personality, have been found to be even stronger predictors of academic performance (Chamorro-Premuzic, 2007). Specifically, conscientiousness, described as thoroughness, carefulness, organized, and efficient, has consistently shown to be a stronger predictor of academic performance than intelligence (Moutafi, Furnham, & Paltiel, 2004; Roberts, Lejuez, Krueger, Richards, & Hill, 2014; Wood & Englert, 2009).

Moreover, the predictive power of intelligence on academic performance seems to decrease as students reach higher academic levels (Furnham & Bachtiar, 2008; Sanders, Osborne, & Greene, 1955). Researchers argued this is probably due to different forms of assessments (continuous assessments and coursework over long periods of time) and restrictions in range of intelligence (students that go to university are smarter as a group than high school students, making intelligence more homogeneous). Consequently, research suggests that conscientiousness is a stronger predictor of academic performance in higher education than intelligence (Chamorro-Premuzic & Arteche, 2008; Chamorro-Premuzic, 2006). Accordingly, Chapter 6 investigates the overlap between the attractiveness of intelligence and conscientiousness, as well as the predictive power of conscientiousness over intelligence in predicting academic performance.

2.3 Summary

Given the multifaceted debate among experts in the field of intelligence, there are various definitions of intelligence. Some people may think that intelligence is fixed and does not change considerably (like fluid intelligence); while others may think it accumulates over time (like crystalized intelligence). Likewise, some might agree on an incremental or entity theory of intelligence, but hold significantly different opinions on whether there is one general type of intelligence or multiple types of intelligence (or both).

Correspondingly, individuals may differ in the extent to which they believe intelligence predicts academic performance more than hard work or effort. For example, some might argue that it does not matter how much an unintelligent person works; they would be limited in how well they do academically (and indeed this may be true in the extreme lower end of the spectrum marked by learning disabilities). It is possible that each of these ambiguities in the term ñintelligenceò may limit accuracy or consensus in predicting academic performance from facial appearance. By contrast, other aspects of competence and personality may be less ambiguous.

Chapter 6 assesses the potential for individuals to accurately assess academic performance from facial appearance alone by asking them to rate perceived intelligence, conscientiousness, and academic performance. Given the strong implications of the attractiveness halo (discussed more in Chapter 3), we explore whether statistically controlling for facial attractiveness would result in more accurate perceptions of academic performance.

Chapter 3: Attractiveness-Intelligence Halo

3. Halo

As discussed in Chapter 1, individual differences in culture, perceived self-worth, access to medical care, and hormones are just some variables that can influence participantsô preference for facial symmetry and sexual dimorphism. In a similar way, individual differences may influence the degree to which individuals endorse the attractiveness-intelligence relationship in faces, a relationship under scrutiny because of its likely effect on education and other situations where expectations shape performance. This chapter will broadly discuss the attractiveness halo effect, the expectancy effect, and the intelligence-attractiveness halo. It will shed light on why some individuals might perceive a stronger association between intelligence and attractiveness than others (further investigated in Chapter 5).

3.1 Attractiveness and Intelligence Halo

A substantial amount of literature on the ñattractiveness halo effectò shows that people ascribe desirable personality traits to others they find attractive (Dion et al., 1972). One potential explanation for this effect is the ñgood genesò hypothesis; that is, that physical attractiveness is a valid indicator of the ability to pass on other genes that will increase survival and reproductive success (Fisher, 1915). As Chapter 1 described, symmetry (Thornhill & Gangestad, 2006), averageness (Langlois & Roggman, 1990), sexually dimorphic features (Perrett et al., 1998, 1999), skin pigmentation and texture (Fink et al., 2001; Stephen, Law Smith, et al., 2009), and adiposity (Coetzee et al., 2009; Rantala et al., 2013) all influence attractiveness, and each attribute has a relationship to health (Rhodes, 2006). Given the convincing amount of research supporting an association between health and cognitive function, cues to health may also be cues to intelligence (discussed further in Chapter 2).

Kanazawa and Kovar (2004) examine the relationship between actual intelligence and attractiveness by presenting four controversial (see Denny, 2008; Mitchem et al., 2014; Zebrowitz & Rhodes, 2004) assumptions: 1) men with higher intelligence scores are more likely to attain higher status than men with lower intelligence scores; 2) higher-status men are more likely to mate with attractive women than lower-status men; 3) intelligence is heritable; and 4) beauty is heritable (p.228-229). Hence, they conclude, because higher-status men have higher intelligence scores and are more likely to mate with attractive women than lower-status men, their offspring are attractive (because of their mothers) and intelligent (because of their fathers); thus, there is a greater likelihood of an attractive person being intelligent.

Kanazawa and Kovarôs (2004) assumptions have not proven resilient. Denny (2008) points out that there are beautification practices available to members of higher socioeconomic strata. These practices might misrepresent an otherwise less attractive female as more attractive and, therefore, lead the female to be more likely to mate with a higher-status male. Further, research suggests that personality is a stronger indicator of academic and work performance than intelligence (Chamorro-Premuzic, 2007), thus, men of high status do not necessarily have high intelligence (discussed further in Chapter 2). These flawed assumptions perhaps explain the lack of empirical studies replicating Kanazawa and Kovarôs (2004) findings that attractive people are more intelligent (Denny, 2008; Mitchem et al., 2014; Zebrowitz, Hall, Murphy, & Rhodes, 2002; Zebrowitz & Rhodes, 2004).

Correspondingly, Zebrowitz and Rhodes (2004) investigated the relationship between facial attractiveness and actual intelligence in the upper and lower halves of the attractiveness distribution. Results indicated that facial attractiveness and actual intelligence were only significantly correlated in the lower half of the attractiveness distribution (i.e., individuals who were less than average attractive were usually less intelligent). Consistent with the ñanomalous face overgeneralization hypothesis,ò attractiveness was used (spuriously) as a cue to intelligence across the entire attractiveness distribution, but participantsô judgments of intelligence only applied with any accuracy to faces they considered less attractive (Zebrowitz & Rhodes, 2004).These findings are consistent with the ñbad genesò hypothesis, which implies that unattractive faces are a signal of poor genetic fitness, and that faces rated as either average or above average for attractiveness serve as equally relevant signals of genetic fitness.

The most recent of studies on actual intelligence and attractiveness analyzed the largest sample to date (*n*=1354), utilizing a twin dataset; it found no support for a relationship between actual intelligence and perceived facial attractiveness (Mitchem et al., 2014). Therefore, while the good (or bad) genes theory may help explain why individuals draw the relationship between attractiveness and *perceived* intelligence there is not sufficient evidence for a relationship between attractiveness and *actual* intelligence.

3.2 Attractiveness and the Expectancy Effect

The expectancy effect, demonstrated by the classic Pygmalion study (Rosenthal & Jacobson, 1968), suggests that expectations alone are capable of influencing the targetôs actual performance. The attractiveness halo has also been studied extensively in relation to its influence on expectations of academic performance (Byrne, London, & Reeves, 1968; Landy & Sigall, 1974; Miller, 1970). It is clear that people ascribe positive educational traits such as intelligence and academic potential to students they consider attractive more strongly than to students they consider unattractive (Dusek & Joseph, 1983; Ritts, Patterson, & Tubbs, 1992). These studies show that variables like gender, race, and past performance affect expectations, but are not significant moderators to the attractiveness halo effect.

Given the influence of the expectancy effect on studentsô future performance (de Boer, Bosker, & van der Werf, 2010; Rosenthal & Jacobson, 1968) and the influence that attractiveness has on expectations (Dusek & Joseph, 1983; Langlois et al., 2000; Ritts et al., 1992), it is not surprising that students rated as more attractive would do better academically. Indeed, various investigations examining both standardized test scores and grades across different age ranges and grade levels have shown that students rated as more attractive usually receive higher grades and scores on standardized achievement tests than students rated as less attractive (Felson, 1980; Salvia, Algozzine, & Sheare, 1977; Singer, 1964). Granted, some empirical studies dispute these findings (Clifford, 1975; Sparacino & Hansell, 1979). The difference in study methods, namely how well a teacher knows the student, may explain inconsistencies in findings; while attractiveness may shape expectations, given sufficient time, other information (e.g., perceived effort, previous academic performance, etc.) may be deterring the influence of attractiveness on perceived intelligence, and in turn, mitigating expectancy effects. For instance, Sparacino and Hansellôs (1979) sample of students consisted of a smaller and more intimate class than other studies have investigated; as they point out, these students may have had the opportunity to influence teacher expectations (and potentially their perceived attractiveness), which would sway the power of the expectancy effectös influence on actual academic performance. Their results indicate the importance of expectancy induction; that is, the process by which teachers raise their expectations of students (Raudenbush, 1984). While expectancy induction could occur through experimental manipulation (i.e., telling teachers which students are smarter), it could also happen naturally by teachers expecting more based on first impressions or other perceived qualities related to academic performance (e.g., perceived intelligence, health, etc.).

Given the consistent and sustained impact of these expectations, the focus of concern has been the accuracy of the expectations themselves. Social psychologists typically argue that teachersô perceptions of students are usually inaccurate and that ñteachersô expectancies influence studentsô academic performance to a greater degree than studentsô performance influences teachersô expectanciesò (Miller & Turnbull, 1986, p. 236). Alvidrez and Weinstein (1999) provide an example of potentially inaccurate expectations influencing academic performance by finding that teacher expectancies formed of children as young as four years old (likely inaccurate expectations given the limited information available at such age) significantly predicted high school performance 14 years later, more so than studentsô measured intelligence.

In contrast, educational psychologists have argued that teachersô expectancies can be accurate (Hoge & Coladarci, 1989), and that inaccurate impressions are typically corrected when more dependable performance information becomes available (Brophy, 1985; Jussim, 1986, 1989). Essentially, the influence of the expectancy effect works through a self-fulfilling prophecy. If, however, the ñprophecyò was based on accurate information, the outcome is likely to reflect correctly perceived ability instead of inaccurate expectations. Jussim and Harber (2005) put it best by pointing out that ñas accuracy increases, the potential for self-fulfilling prophecies declines; as accuracy decreases, the potential for self-fulfilling prophecies increasesò (p.138).

Anderson and Rosenthal (1968) argued that timing affects the power of expectancy induction and that test scores produced before teachers had time to get to know their students had a stronger impact on expectancy effects. Claiborn (1969) concurred, finding that expectancy induction had no effect on teachers who had already worked with students for about a month. Taken together, these studies imply that while perceptions of attractiveness play a critical role in influencing expectations, the attractiveness bias has more influence in instances of limited context and contact. Furthermore, when educators have access to other information to guide impression formation (e.g., previous academic performance, perceived motivation, etc.) positive educational attributes may act as a halo, influencing perceived attractiveness; this would also lead to a correlation between perceived attractiveness and actual academic performance.

3.3 Intelligence and Attractiveness Halo

The general halo effect suggests that perceived intelligence may confer as strong a ñhaloò as attractiveness. Yet, the bulk of research has investigated the influence of perceptions of physical attractiveness on impressions of personality and intelligence (de Boer et al., 2010; Dion et al., 1972; Dusek & Joseph, 1983; Langlois et al., 2000; Ritts et al., 1992), and only a few investigate the reverse effect.

Cognitive dissonance theory is one potential explanation for the correlation between perceived intelligence and attractiveness. This theory argues that a high correlation between perceived attractiveness and perceived intelligence may stem from a desire to remain consistent with our initial impressions (Aronson, 1969; Asch, 1946; Festinger, 1962). That is, people will experience increased cognitive consistency if they ascribe attractiveness to an individual to whom they have ascribed other positive traits (Asch, 1946). Dion and colleagues (1972) investigated the attractiveness halo in a paper titled ñWhat is Beautiful is Good,ò and Gross and Crofton (1977) responded with a paper titled ñWhat is Good is Beautiful,ò finding that observers perceived female students as more attractive if the observers had received a favorable descriptions of the studentôs personality as well as the studentôs photograph. Owens and Ford (1978) tested these findings with images of males and females and found similar effects for female but not male images. Two separate studies have argued that external validity for the previous research supporting the attractiveness stereotype is weak (Eagly, Ashmore, Makhijani, & Longo, 1991; Felson & Bohrnstedt, 1979). Felson and Bohrnstedt (1979) suggest that in a more natural setting, such as one with a more realistic amount of information available, people are less likely to rely upon appearance in personality or ability judgments, and instead are more likely to use ability judgments to form impressions of attractiveness (see comment by Campbell, 1979 for a more detailed review of the causal relationships deduced and reconciliation with previous experimental results). Thus, the direction in which the halo influences judgments (perceived intelligence influences perceived attractiveness vs. perceived attractiveness influences perceived intelligence) seems dependent on the amount of information available to the perceiver. That is, in situations in which little information is available and perceptions of physical appearance are readily available, perceptions of attractiveness will dominate impression formation until more information is gained.

Kniffin and Wilson (2004) conducted three naturalistic studies and provided evidence for the importance of the differences in impression formation after familiarity, as well as non-physical factors influencing perceptions of physical attractiveness. These researchers found that non-physical factors such as ratings of familiarity, respect, liking, and intelligence, had a significant influence on the perception of physical attractiveness (Kniffin & Wilson, 2004). More recent research by Zhang, Zong, Zhong, and Kou (2014) had participants rate the attractiveness of facial stimuli without any information about their personalities, then rate the same faces two weeks later with positive information, no information, or negative information paired with the facial stimuli. Results indicated support for a ñwhat is good is beautifulò effect in which positive personality influenced increased positive ratings of attractiveness during the second round of rating the same stimuli. Similarly, research has found that group membership can taint perceptions of attractiveness, with followers of a particular group rating their own group leaders as more physically attractive than leaders of competing groups (Kniffin, Wansink, Griskevicius, & Wilson, 2014).

Byrne (1961) indicates a strong correlation between interpersonal attraction and attitude similarity by showing that a participant who believes they share similar attitudes with a stranger will judge the self-similar stranger more positively. Participants will also judge the stranger as better adjusted, better informed, more moral, and more intelligent as compared to a stranger who holds dissimilar attitudes (Byrne, 1961). Park and Schaller (2005) explain that individuals are more likely to express willingness to help a hypothetical person who maintains similar attitudes. Hence, it is possible that perceived similarity in intelligence would result in a similar effect of biasing future judgments of that similar-intelligence stranger in a positive light.

3.4 Individual Differences

In light of the possibility of an ñintelligence haloò, in which perceptions of intelligence can influence perceptions of attractiveness, individual differences may influence the degree to which people find intelligence attractive. Indeed, people appear to consider others who resemble themselves as more intelligent or attractive, whether the other person is a stranger (Byrne, 1961) or a potential mate (Buss, 1985; Jensen, 1978; Reynolds, Baker, & Pedersen, 2000).

3.4.1 Assortative mating

As discussed in Chapter 1, the good genes hypothesis attempts to explain how valid signals of actual health (e.g., symmetry, averageness, etc.) can influence perceptions of attractiveness. Given the relationship between actual intelligence and actual health (Bishop, 2009; Eysenck, Derakshan, Santos, & Calvo, 2007; Gregg, 2000; Ohayon & Vecchierini, 2005; Okereke & Grodstein, 2013; Yassuda et al., 2012), it is plausible that honest signals of health may extend to perceptions of intelligence. Assortative mating, defined as the pairing of individuals based on their similarity to each other, may provide insight on individual differences for the degree of attractiveness of signs of ñgood genesò or indicators of health and intelligence. Humans have been known to assort on inherited attributes such as height and weight (Ginsburg, Livshits, Yakovenko, & Kobyliansky, 1998), as well as non-inherited attributes such as altruism and education (Tognetti, Berticat, Raymond, & Faurie, 2014). Indeed, research has highlighted evidence of assortative mating in a variety of other variables, including age, religion, socioeconomic status, ethnicity, personality traits, and social attitudes (Buss, 1985). Research by Rushton and Nicholson (1988) found evidence suggesting that spouses select each other on the basis of genetic similarity both within and across cultures. Research has found that assortment continues even within groups already selected on the basis of proximity (Rushton, Littlefield, & Lumsden, 1986), indicating that assortment is not simply related to a shared environment.

Based on the literature supporting the assortment of intelligence (Jensen, 1978; Price & Vandenberg, 1980; Reynolds et al., 2000; Vandenberg, 1972) and research on the heritability of general intelligence (Bartels, Rietveld, Van Baal, & Boomsma, 2002; Deary, Spinath, & Bates, 2006; Neisser et al., 1996; Plomin & Spinath, 2004), Miller (2000) argued that intelligence is sexually, rather than naturally, selected. Hence, an individualøs attraction to a face perceived to be intelligent may partially depend on an observerøs own intelligence.

3.4.2 Mate value and standards

In line with the idea that an individualøs intelligence influences perceptions of othersô attractiveness, evidence from several species suggests that individuals with ñhigh-quality genesò show stronger preferences for good gene markers (i.e., symmetry) than those with ñlower quality genesò (Bakker, Zunzler, & Mazzi, 1999; López, 1999; Mazzi, Künzler, & Bakker, 2003). Women who consider themselves more attractive preferred more masculine faces (a trait that has been argued to signal stronger immunity; see Rhodes, Chan, Zebrowitz, & Simmons, 2003, but also see Scott, Clark, Boothroyd, & Penton-Voak, 2013) and also more symmetric male faces than women who considered themselves less attractive (Kandrik & DeBruine, 2012; Little, Burt, Penton-Voak, & Perrett, 2001; Vukovic et al., 2010). Likewise, females who reported lower self-esteem rated less masculine men as more attractive (Johnston et al., 2001). Accordingly, an evolutionary perspective on perceived mate value and selection standards would suggest individuals with low mate value may adopt lower standards in mate choice, which may reflect an adaptation to avoid the costs of decreased paternal investment or potential abandonment from higher-quality partners (Little et al., 2001; Pawġowski & Dunbar, 1999).

A social psychological perspective would suggest that the importance of oneøs self-evaluation in favorability to others may be related to a social exchange or equity model of mate selection (Blau, 1968; Hatfield, Traupmann, & Sprecher, 1985; Hatfield, Walster, Walster, & Berscheid, 1978; Murstein, 1970). These social exchange type models suggest oneøs own ñmarket-valueò impacts on oneøs trading value, and as such potential partners will attempt to get the best bargain in exchange for their own social assets (Cameron, Oskamp, & Sparks, 1977; Kenrick, 1994; Regan, 1998). Murstein (1970) argued that while seeking a less desirable partner has a low cost (because of a lower risk of rejection), it also has low profit; whereas, seeking a partner who is more desirable than oneself bears high profit and high cost. Thus, the mating game is one of risks, and an accurate self-evaluation would be advantageous. Indeed, there is evidence to suggest a weak, but significant correlation between self-rated intelligence and actual intelligence (Furnham & Rawles, 1999; Furnham & Chamorro-Premuzic, 2004; Paulhus, 1998), supporting the possibility that more intelligent people know their worth and that their preferences for intelligence will reflect this.

3.4.3 Kin selection

Further evidence of a self-similarity preference is kin selection, in which individuals will favor others that are genetically similar (Hamilton, 1964). Rushton (1988) extends the concept of kin selection to Genetic Similarity Theory, by suggesting we are not only biased toward kin, but toward strangers whom we identify as being genetically similar. In turn, it seems there are various mechanisms that suggest individuals may vary in the extent to which they find particular traits (like intelligence) attractive and these individual differences seem related to self-similarity. Theories of kin selection and their relation to individual differences in perceptions of intelligence will be discussed alongside Chapter 5, which investigates the role of oneǿs own intelligence on perceptions of intelligence in childrenǿs faces.

3.5 Summary

For decades, research has explored the influence of the attractiveness halo and its relationship to perceptions of intelligence and expectancy effects. While some have argued attractiveness and *actual* intelligence are linked (Kanazawa, 2004; Kanazawa, 2011; Zebrowitz et al., 2002), evidence is debated and at best weak (Mitchem et al., 2014). Nonetheless, literature on the topic has consistently shown evidence to suggest a strong link between attractiveness and *perceived* intelligence (Byrne et al., 1968; Dusek & Joseph, 1983; Langlois et al., 2000; Miller, 1970; Ritts et al., 1992).

The influence of perceptions of attractiveness on impressions of intelligence is particularly worrying, given research showing that teachersô perceptions of studentsô intelligence affects student performance (Anderson & Rosenthal, 1968; de Boer et al., 2010). While research suggests teachers expect more from students rated as attractive (Dusek & Joseph, 1983; Ritts et al., 1992), it has also been argued that knowing a student and being familiar with previous performance records can influence perceptions of intelligence and attractiveness accordingly (Jussim, Eccles, & Madon, 1996; Jussim, 1986, 1989).

While most research has investigated the effects of attractiveness on impressions of personality and intelligence, less research has investigated the opposite influence, the influence of perceived intelligence on attractiveness. Research suggests non-physical attributes, including intelligence, can influence perceptions of attractiveness (Kniffin & Wilson, 2004). As discussed in Chapter 1, individuals can vary in their preferences for certain physical attributes (i.e., people who prefer extroversion in a mate are more likely to rate extraverted faces as more attractive than introverted faces). Likewise, research on assortative mating, kin selection, mate value, and genetic similarity theories suggest individuals often favor others who are self-similar, which suggests individuals may differ in the degree to which they find certain non-physical attributes (like intelligence) attractive. Given evidence to suggest a self-similarity bias, Chapter 5 investigates whether an individualȇs own intelligence influences the extent to which an individual rates a face he or she perceives to be intelligent as attractive.

Overview of Experimental Chapters

As discussed in Chapter 1, the face provides cues to various attributes such as health, aggression, and strength (to name a few). Yet, individuals often overgeneralize from facial cues to form impressions. Given the relationship between eyelid-openness and mouth curvature in relation to alertness and mood, Chapter 4 investigates the potential for these cues to influence perceptions of intelligence.

Chapter 3 discusses the strong relationship between perceived attractiveness and intelligence, which emphasizes the need to investigate whether the cues of eyelid-openness and mouth curvature effect perceptions of intelligence directly or indirectly through an influence on perceptions of attractiveness. Using mediation analysis, we investigated the impact of eyelid-openness and mouth curvature across adult (Study 1) and children stimuli (Study 2), as well as through digital manipulation of these cues alone (Study 3) and natural variation in images of individuals before and after sleep restriction (Study 4).

While Chapter 4 investigates the relationship between perceived intelligence and attractiveness at the stimuli level, Chapter 5 explores which individuals endorse the perceived intelligence-attractiveness relationship more than others. Given the self-similarity biases discussed in Chapter 3 (and discussed more in Chapter 5), it was predicted that individuals with higher intelligence would show a stronger endorsement of the perceived intelligence-attractiveness relationship. While Chapter 4 investigates the relationship between facial cues and the attractiveness and intelligence halo and Chapter 5 investigates the role of oneȇs own intelligence on the degree of endorsement of the perceived intelligence-attractiveness halo, Chapter 6 will assess whether individuals would be more accurate in perceiving academic performance from faces when statistically controlling for attractiveness bias and being more specific about perceived competence tasks.

Chapter 4: Perceived Intelligence: Beyond the Attractiveness Halo

This chapter is based on research that is under peer-review in an academic journal:

Talamas, S.N., Mavor, K. I., Axelsson, J., Sundelin, T., & Perett, D. I. (in revision). Perceived intelligence: Beyond the attractiveness halo.

4. Abstract

Impression formation is profoundly influenced by facial attractiveness, but the existence of facial cues that affect judgments beyond such an ñattractiveness haloò may be underestimated. Over four studies, we investigated malleable facial cues that may influence first impressions of intelligence. In Studies 1 and 2, we scrutinize the perceived intelligence and attractiveness ratings of images of 100 adults (aged 18 - 33) and 90 school-aged children (aged 5 - 17) respectively. Intelligence impression was partially mediated by attractiveness, but independent effects of eyelid-openness and subtle smiling were found that enhanced intelligence ratings independent of attractiveness. To investigate whether these cues were specifically and independently influencing perceptions of intelligence, in Study 3 we digitally manipulated stimuli to have exaggerated eyelid-openness and mouth curvature and found that each independent manipulation had an influence on perceptions of intelligence. In a final set of stimuli (Study 4), we explored changes in these cues before and after sleep restriction, to examine whether natural variations in these cues according to sleep condition can influence perceptions. In Studies 3 and 4 variations in eyelid-openness and mouth curvature were found to influence intelligence ratings. These findings suggest potential overgeneralizations based on subtle facial cues that indicate mood and tiredness, both of which alter cognitive ability. These findings have important implications for students who are directly influenced by expectations of ability and teachers who may form expectations based on initial perceptions of intelligence.

4.1 Introduction

As discussed in the introduction (see Chapter 3), physical attractiveness has long been claimed to produce a favorable bias. In many studies of the attractiveness halo, attractiveness is assumed to be a stable characteristic of faces, but we argue for a focus on more dynamic and malleable facial cues. Malleable cues can also operate as a form of halo bias, but are amenable to change, thus allowing some control over the halo effect.

Considering first existing work on the ñattractiveness haloò, perceptions of attractiveness are strongly correlated to perceptions of intelligence (Eagly et al., 1991; Langlois et al., 2000; Ritts et al., 1992). Rosenthal and Jacobsonôs (1968) Pygmalion study showed that teacher expectations of intelligence affect students' achievement (see also Babad, Inbar, & Rosenthal, 1982). If an attractive student were perceived as more intelligent, the expectancy effect suggests higher expectations would be placed on attractive students over unattractive students and, through greater attention and other forms of self-fulfilling prophecies, these expectations could in turn influence academic achievement (Clifford & Walster, 1973). Although there are specific exceptions to the rule (such as the ñdumb blondeò or less attractive ñnerdò stereotypes), there is evidence that the general rule holds more broadly (Ritts et al., 1992).

Specifically, a meta-analytic review by Ritts et al. (1992) found that attractive students are more likely to be ascribed positive educational traits than unattractive students. Attractive students were judged as more intelligent, having more academic potential, better grades, and various other positive educational traits. It was further noted that other variables like gender, race, and past performance also affected expectations, but did not significantly moderate the attractiveness effect. Effects of attractiveness also seem to be sustained over time. Boer, Bosker, and Werf (2010) conducted a longitudinal study consisting of approximately 11,000 students over five years and found that there was a significant relationship between teacher expectation bias and student performance after five years, such that higher expectation by teachers led to sustained higher performance.

Thus, it is clear that, even if later corrected, initial expectations can have important consequences and ratings of facial attractiveness are a known source of initial impression formation (Bar, Neta, & Linz, 2006; Todorov, Mandisodza, Goren, & Hall, 2005;

Zebrowitz, 2004). Langlois, Ritter, Casey, and Sawin (1995) found that even maternal interactions (where familiarity is clearly high) are more positive with attractive children compared to unattractive children. Attractiveness judgments themselves are surprisingly consistent across observers: a meta-analytic review by Langlois et al. (2000) found high inter-rater reliability regarding opinions of facial attractiveness for both men and women, as well as across different countries.

4.1.1 Static and dynamic facial cues

Research by Hehman, Flake, and Freeman (2015) has highlighted the vital differences between static and dynamic facial cues and their varying impact on assessments of intentions (e.g., trustworthiness, warmth, valence) vs. ability (e.g., physical ability, power). Specifically, it was found that judgments of intentions tend to be based on dynamic facial cues that can change in a short time scale due to the action of facial musculature. Evaluations of ability were found to be more consistent and rely heavily on static facial cues that are dependent on underlying bone structure and hence are less likely to change across multiple instances (Hehman et al., 2015).

Much of the research investigating attractiveness and the ñattractiveness haloò has focused on the fixed or static structural facial traits of symmetry, averageness, and sexual dimorphism (Langlois & Roggman, 1990; Perrett et al., 1998, 1999). A ñgood genesò theory of mate selection argues that these fixed traits are attractive because of their relationship to health (Rhodes, 2006). For instance, a symmetric face may be perceived as attractive because it may denote disease resistance (Thornhill & Gangestad, 2006). An average face may be perceived as attractive because at the psychological level it is less unusual, different, or weird. At the biological level, ñgenetic and environmental stress can produce deviations from averageness and symmetry of the human faceò (Zebrowitz & Rhodes, 2004, p. 169). Similarly, the immunocompetence-handicap hypothesis (Rhodes et al., 2003) posits that the increased testosterone levels men need to develop sexually dimorphic traits also stress the immune system. Thus, only men with a strong immune system would be capable of withstanding this challenge and are able to grow and sustain masculine traits while remaining healthy. However, the immunocompetence-handicap hypothesis is controversial and recent research supports masculinity only having a limited influence on attractiveness of male faces (Rantala et al., 2013; Scott et al., 2013), and the effect of masculinity on facial attractiveness is not necessarily consistent across cultures (Stephen et al., 2012). While the described stable traits (symmetry, averageness, masculinity) may all contribute to attractiveness (see Chapter 1), less research has been done on malleable cues to attractiveness and perceived intelligence.

Perhaps students with asymmetric or unique faces may not be doomed to low expectations based on their low perceived attractiveness and hence lowered perceived intelligence. A number of more malleable characteristics have also been shown to affect impressions of attractiveness. For example, skin color and texture are facial cues that can change over relatively short timescales. These skin cues have been found to influence attractiveness and signify current state of health in many species including humans (Fink et al., 2001; Stephen, Law Smith, et al., 2009). We argue here that subtle mouth curvature and eye size cues might also have important impact on perceived attractiveness and intelligence.

4.1.1.1 Mouth curvature

Smiling is a malleable facial cue that enhances attractiveness (Conway et al., 2008) and increases the rewarding nature of facial attractiveness (OöDoherty et al., 2003). In turn, smiling has been shown to have a ñhalo effectò of its own, with the more frequent ascription of desired traits to people who smile over those who do not (Lau, 1982). While a large grin could be interpreted as a naive gesture, we argue that a slight upturn in mouth curvature (i.e., a subtle smile) is likely to influence perceived intelligence in a number of ways. Subtle differences in individual anatomy and facial feature configuration could be reminiscent of emotional expressions[1]. Such hints of expression in supposedly neutral faces are known to affect the attribution of personality traits (Borkenau & Liebler, 1992; Kenny, Horner, Kashy, & Chu, 1992; Kleisner, Chvatalova, & Flegr, 2014; Said, Baron, & Todorov, 2009; Sutherland et al., 2013; Zebrowitz, Kikuchi, & Fellous, 2010). Additionally, a sad mood has been shown to significantly reduce cognitive performance (Ellis, Thomas, & Rodriguez, 1984). Someone who is smiling is also likely to be perceived

[1] The term *mouth curvature* is used throughout most of the paper instead of smiling or frowning because the faces observed were considered neutral; not overtly smiling or frowning. Thus, the subtle differences influencing perceptions are not based on an overt emotion, but rather the shape of the mouth.

as more trustworthy (Oosterhof & Todorov, 2008), approachable, engaged and willing to interact (Jones, Debruine, Little, Conway, & Feinberg, 2006). Consequently, subtle smiling may be a malleable facial cue that enhances perceived intelligence independent of the attractiveness halo.

4.1.1.2 Eye size effects

Subtle smiling and eyelid-openness are characteristics that we will examine in depth as potentially important malleable cues to both attractiveness and intelligence. In exploring eyelid-openness effects, however, we need to consider eye size more broadly, and in particular the relationship between eye size and the phenomenon of neoteny (the attractiveness of more ñbaby-facedò features; Guthrie, 1970). Cunninghamôs (1986) multiple motives hypothesis of physical attractiveness suggests people are attracted to individuals who display a combination of youthful (neotenous), mature, and expressive facial features. One fixed feature of neoteny that is considered attractive in both females and males is large eyes (Cunningham, Barbee, & Pike, 1990; Cunningham, 1986).

For our purposes it is critical to note that the measurements used in Cunninghamôs (1986) study do not differentiate between eye size and eyelid-openness, whereas that distinction is crucial to our hypotheses. Cunninghamôs (1986) measure of eye size is the vertical separation of eyelids relative to vertical height of the face (forehead to chin) multiplied by the average width of each eye relative to the width of the face. We propose a measure of eyelid-openness as a different cue to social judgments as well as a contribution to Cunninghamôs (1986) measure of eye size. Indeed, we argue that eye size and eyelid-openness may actually elicit distinct social impressions. Neotenous features such as large eyes and foreheads, and small chins and noses, may trigger a caring response and the perception of childlike traits including naivety as part of an infant schema (Zebrowitz & Montepare, 1992), whereas eyelid-openness may convey alertness. Taken together, these arguments suggest there can be a conflict between perceived intelligence and perceived attractiveness based on these fixed structural cues to age: people with large eyes should be perceived as attractive, youthful, but potentially naïve and hence less intelligent. Since we are interested in the effects of eyelid-openness over and above the effects of fixed facial features, we adopt a new approach to measuring eyelid-openness that controls for any underlying effects of eye size.

4.1.1.3 Tiredness

Tiredness can also change over a relatively short time scale and has been shown to significantly reduce cognitive performance (Lim & Dinges, 2010; Pilcher & Huffcutt, 1996; Thomas et al., 2000; Walker, 2009). Facial cues of sleep deprivation have been shown to affect perceptions of attractiveness negatively (Axelsson et al., 2010). Sleep-deprived individuals also look sadder than non-sleep-deprived individuals, with corners of the mouth pointing downward (Sundelin et al., 2013). An upturned mouth curvature may thus reflect alertness, but tiredness may also be reflected in the more direct facial cue of eyelid-openness; those who are sleep deprived are likely to have less eyelid-openness than those that are well rested (Sundelin et al., 2013). Additionally, overgeneralization of the relationship between tiredness and impaired cognitive performance may mean that facial cues related to tiredness influence perceptions of intelligence beyond the effects of attractiveness.

4.2 Overview of the Studies

Our overall aim was to examine how malleable facial cues relate to perceived intelligence by focusing on the role of facial cues to mood and alertness. Since both low mood and tiredness can impair cognitive performance, we hypothesized that (malleable) cues to mood and tiredness might affect attributions of intelligence through overgeneralizations. Cues to low mood and low alertness may also have a detrimental impact on attractiveness and therefore such cues could influence attributions of intelligence indirectly through the reduction in attractiveness. Alternatively, the same facial cues may affect impressions of intelligence directly and independently of attractiveness judgments. We were therefore interested in exploring the direct effects of malleable facial cues on intellectual attributions, as well as any indirect effects mediated through the impact on attractiveness.

We began by examining attributions made to adult faces in images chosen to depict a neutral state without any posed expression of emotion. The images employed were from a human photo reference agency and had no overt facial expressions. Since we were particularly interested in investigating the effects of malleable cues in forming teacher expectation during early education, we also replicated the experiment with images of childrenôs faces with neutral expressions. We then digitally manipulated the mouth curvature and eyelid-openness of stimuli independently to control for any other facial cues or combination of facial cues that could be driving impressions.

Finally, to investigate the malleable nature of these facial cues and to support ecological validity of the digital manipulation findings, we ran a fourth study to determine how subtle changes in facial appearance might alter trait attributions in sleep restricted individuals. We compared pairs of images of the same individuals rested and after sleep restriction. We assumed that, on average, sleep restriction will increase the tiredness of participants and will affect mood adversely. We note that tiredness is a common phenomenon that most adults and children experience and may well affect some individuals often and adversely during their education or employment (e.g., Oginska & Pokorski, 2006; Perkinson-Gloor, Lemola, & Grob, 2013; Perkinson-gloor et al., 2015). Hence, it is likely that cues to tiredness, such as eyelid-openness and subtle frowning will affect attributions and quite possibly expectations of performance.

4.3 Study 1: Adult Faces

To examine cues of perceived intelligence across a stimuli set of 100 facial images, participants were asked to rate facial images of adults with neutral expressions for attractiveness and perceived intelligence. Objective measurements of eyelid-openness and mouth curvature were calculated and validated to assess the influence of these cues to alertness and mood on perception of attractiveness and intelligence. We hypothesized that eyelid-openness and hints of positive affect (upturned mouth curvature) would enhance attribution of both attractiveness and perceived intelligence. We analyzed whether the impact of these facial cues on perceived intelligence was mediated by attractiveness, or whether effects were independent of attractiveness. We also controlled for the fixed trait of eye size, and we expected that large eyes would enhance ratings of attractiveness (Cunningham, 1986), but not necessarily intelligence. Further, we examined the effect of gender since this variable might affect perceived intelligence through biased expectations of male intelligence (Beloff, 1992; Byrd & Stacey, 1993; Furnham, Reeves, & Budhani, 2002) or female attractiveness (Cunningham, 1986; Perrett et al., 1998).

4.3.1 Method

4.3.1.1 Face stimuli

The stimuli were 100 Caucasian two-dimensional faces that included 50 males (M_{age} = 25.3, SD = 4.64) and 50 females (M_{age} = 23.2, SD = 3.74). These were chosen as the most standardized (e.g., clean shaven, neutral head posture) faces from a commercial database (available at www.3d.sk) designed for use in media and gaming development. An equal number of participants in each gender were purposefully chosen, but age of stimuli was not a part of selection criteria (no particular age range used for exclusions). All photographs chosen for this study were taken with a standardized camera set-up and lighting conditions; individuals had their hair pulled back, did not wear make-up or jewelry, and were instructed to pose with a neutral facial expression.

Using the Psychomorph software, all face images were manually delineated with 188 points (Tiddeman et al., 2001). Points were placed on face feature landmarks (e.g., center of the pupil, eye corners and at regular intervals along the contours of facial features). Custom digital software was used to then measure the distance between delineation points for the objective measures calculated. Face images were aligned in size and position based on left and right pupils. Images were then resized and cropped (1608 x 2584 pixels) so that an equal proportion of hair and neck was shown in each image.

4.3.1.2 Objective measurements of facial stimuli

The degree of eyelid-openness was examined by taking the vertical distance from the center of the pupil to the top eyelid and dividing it by the width of the eye inner canthus to outer canthus (Figure 4.1). This measure was used because as an eyelid closes with tiredness, it is the top eyelid that lowers, rather than both eyelids meeting in the center[2]. Cunninghamôs (1986) measurements of eye size (average width of each eye relative to the width of face multiplied by the vertical separation of eyelids relative to vertical height of the face forehead to chin) were also calculated.

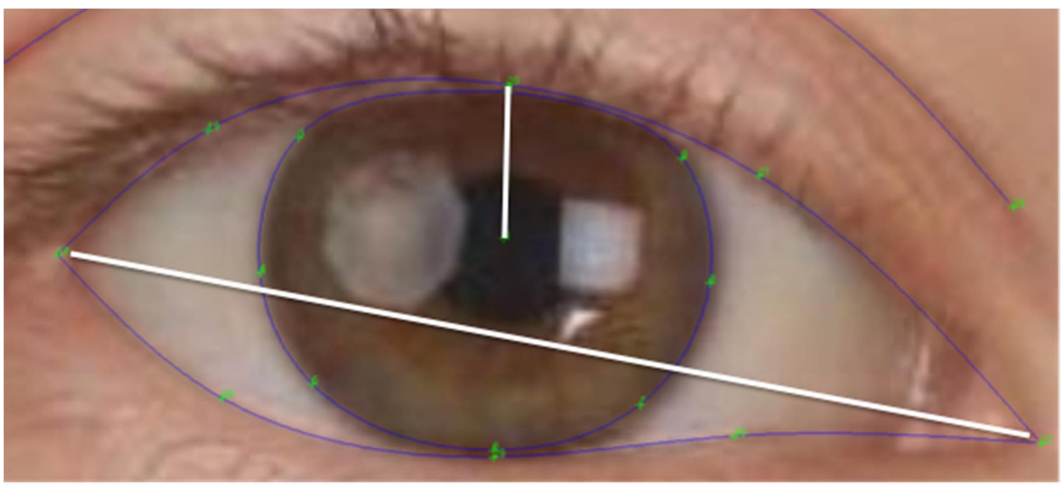


Figure 4.1. Eyelid-openness calculation. Eyelid-openness was calculated by taking the distance from the center of the pupil to the top eyelid (vertical white line) and dividing it by the width of the eyelid from corner to corner (diagonal white line).

[2] Slow motion video of eye opening and closing can be seen at https://youtu.be/okvaOOTvCBw

Lastly, despite images supposedly showing neutral facial expressions, measurements of mouth curvature were calculated by taking the average height of the right and left corners of the mouth, subtracting the height of the center of the mouth and dividing by the width of the mouth (Figure 4.2).

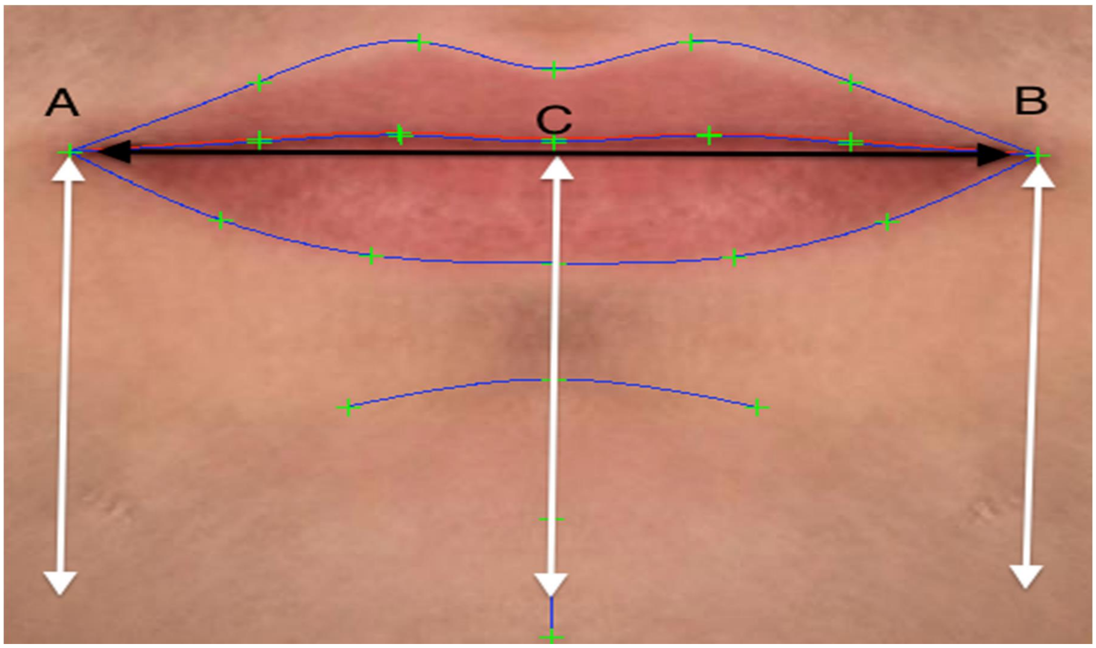


Figure 4.2. Mouth curvature measure. Example delineation points marked as A (height of left side corner of mouth), B (height of right corner of mouth), and C (height of center of mouth). The height of the center of the mouth (C) was subtracted from the average height of the corners of the mouth (A & B). This number was then divided by the width of the mouth (distance from A to B). The following formula was used to measure mouth curvature: Mouth corner height relative to center of mouth = (yA+yB)/2 - yC ; Width of mouth = sqrt(xA-xB) ^{2}+(yA-yB)^{2}; Mouth curvature = Mouth corner height relative to center of mouth / Width of mouth.

4.3.1.3 Perceptual rating validation of objective measures

Perceptual ratings of smiling and eyelid-openness were collected to validate the physical facial measurements and determine observersô awareness of cues that could potentially influence the attribution of intelligence. With perceptual validation, future research could use measurements of eyelid-openness and mouth curvature in lieu of perceiver ratings.

A group of 19 own-ethnicity participants (10 female, 9 male, $M_{age} = 27$, $SD = 12.95$) were recruited in an online experiment which (along with the other online studies presented in this thesis) was advertised via the Perception Lab website (www.perceptionlab.com) and Facebook page (www.facebook.com/PerceptionLabStAndrews). No course credit or compensation was allotted. Participants were asked to rate the stimulus faces for degree of eyelid-openness. Given previous work (Elfenbein & Ambady, 2002, 2003) that has highlighted differences in ability to recognize emotions on own- and other-race faces, exclusions were made on the basis of participant ethnicity (four participants excluded; this exclusion criteria was also used in Chapters 5 and 6). Ratings in this task were of a very specific facial feature, hence fewer participants were studied compared to later tasks with more global ratings of attractiveness and perceived intelligence.

Participants first previewed the images, with each face being displayed for one second. After becoming familiar with the stimuli, participants were presented with a scale from 1 ï 7 and received these instructions: ñfocusing on the eyelids, please rate the degree of eyelid-openness in this face compared to other faces presented.ò Stimulus order was randomized. Ratings of eyelid-openness for each face were averaged across all participants and correlated with the objective face measurements of eyelid-openness. As expected, the perceptual ratings of eyelid-openness correlated strongly with the physical measurements ($r(100) = 0.78$, $p < 0.001$).

The measure of mouth curvature takes into account both positive and negative reflections of a subtle smile/frown. Therefore in a separate experiment, instead of getting evaluators to rate the degree of smiling on a scale from 1-7[3], we emphasized to evaluators the subtlety of expression and allowed evaluators to give a response that reflects either a

[3] A separate experiment ($n = 23$), in which raters were asked to ñrate the degree of smilingò for the same faces on a scale from 1-7, these perceptual ratings did not correlate significantly with objective measures of mouth curvature ($r(100) = -0.01$, $p = 0.959$). In this experiment, the subtly of differences in mouth curvature was not emphasized, highlighting that these faces were perceived generally as being neutral. Also, raters were asked to rate the smile, but unable to report a frown.

downward or an upward mouth curvature. A total of 51 new Caucasian (11 non-Caucasian excluded) participants (39 females, 12 males, M_{age} = 25.6, SD = 9.44) were recruited in an online experiment titled ñRate Smiles in Models.ò Participants again previewed the stimuli (same set of stimuli as above) and were given the following instructions: ñPlease keep in mind that all the faces presented appear to have a neutral expression. None of these faces are meant to have obvious smiles. We are examining very subtle differences in mouth curvature.ò Evaluators were then presented with a face and asked: ñfocusing on the mouth, please rate the degree of mouth curvature in this face compared to the other faces presented.ò Evaluators were able to use an unmarked sliding scale with end points labeled *downward mouth curvature* and *upward mouth curvature*; responses on the scale were recorded as an integer from 1 to 100. Perceptual ratings of smiling significantly correlated with objective measurements of mouth curvature ($r(100) = 0.77$, $p < 0.001$). Results provide evidence that subtle differences in smiling and frowning are perceivable. Indeed perceptual reports differentiate faces with a slight upturn or downturn in mouth curvature and show congruence with image measurements of mouth curvature.

4.3.2 Participants

4.3.2.1 Intelligence evaluators

After exclusions, a total of 173 participants (99 female, 74 male, M_{age} = 28.26, SD = 11) completed an online study entitled ñSmart or Not.ò Participants assigning very similar ratings to all images (standard deviation of ratings < 0.50) were excluded (13 participants) due to their unusual and limited use of the scale which may indicate inadequate adherence to task instructions or the preconceived notion that social judgments like intelligence cannot be made from facial cues (or is socially undesirable). Further, participants who reported their ethnicity as different from ñwhite Caucasianò (35) were also excluded[4], as stimuli presented were Caucasian and judgments of other ethnicities may be more susceptible to stereotypes (Zebrowitz et al., 2007). Participants were asked to

[4] Non-Caucasian raters were excluded to avoid the ambiguity of any cross-race effects on perceptions of attractiveness and intelligence. Including the non-Caucasian raters for every analysis reported did not change the pattern of results. In most cases, the effects were stronger with these raters included.

rate 100 faces for perceived intelligence. Participants voluntarily gave informed consent and had to be over the age of 18.

4.3.2.2 Attractiveness evaluators

After exclusions, an independent group of 140 participants (69 female, 71 male, M_{age} = 38.11, *SD* = 10.41) were recruited for an online study entitled ñAdult Attractivenessò using Amazon Mechanical Turk and participated for payment to rate faces for perceived attractiveness. The same exclusion criteria used for intelligence evaluators was used for attractiveness evaluators. Two participants were excluded based on a standard deviation of ratings < .50 and 36 participants who reported their ethnicity as different from ñwhite Caucasianò were also excluded.

4.3.3 Procedure

Participants first completed a questionnaire inquiring about their age, gender, ethnicity, and country of origin. Next, participants previewed all stimuli with each image displayed for one second. The stimuli were then re-presented so that participants could rate the perceived intelligence of each face on a 7-point Likert-type scale with endpoints *not at all intelligent* and *very intelligent*. A separate group of evaluators rated the same stimuli on perceived attractiveness of each face on a similar 7-point scale with endpoints *not at all attractive* and *very attractive*. In both experiments, faces were presented in a random order. The minimum viewing time for each image was one second, but no maximum response time was enforced.

4.3.3.1 Statistical analysis

An average score of attractiveness and perceived intelligence was calculated for each of the 100 faces based on the average ratings across all participants. We expected a strong significant correlation between perceived attractiveness and perceived intelligence based on the attractiveness halo. Since our interest was in the impact of facial features on perceived intelligence beyond the attractiveness halo, we used mediation analyses to explore the direct effects of the measurements of eye size, eyelid-openness, and mouth curvature of each face on perceived intelligence and the indirect effects of these variables through perceived attractiveness while controlling for gender. Given that Cunninghamôs (1986) measure of eye size is confounded with our measure of eyelid-openness, we expect these two measurements also to be strongly correlated. To see whether these measures have different relationships with perceptions of attractiveness and intelligence we examine models with the measurements of eyelid-openness and eye size included separately and with both measures in the mediation analysis, as we believe a more valid measure of eye size is one that controls for variation in eyelid-openness.

An exploratory analysis of data was conducted to determine if the variables used were normally distributed. Results for the Kolmogorov-Smirnov test for normality indicated that measurements of mouth curvature and eyelid-openness, as well as averaged ratings of attractiveness and perceived intelligence did not deviate significantly from normal distribution. There were no problems with multicollinearity between variables (Variance Inflation Factor (VIF) for all variables < 1.5).

4.3.4 Results

4.3.4.1 Facial averaging

To help the reader visualize both the nature and subtlety of cues to perceived intelligence, differences are illustrated by facial averages of faces scoring low and high on perceived intelligence (Benson & Perrett, 1992; Benson & Perrett, 1993). Facial averages were constructed to examine the cues of perceived intelligence/attractiveness in male and female faces separately. Facial averages were synthesized from the top 20 male and female faces (10 male and 10 female faces) and bottom 20 male and female faces with the highest and lowest scores on perceived intelligence (Figure 4.3). This process (a) computes the average x and y values for 188 facial landmarks within the set of face images, (b) warps each shape of each facial image into these average coordinates, and then blends the warped component images (Re & Perrett, 2012; Tiddeman et al., 2001). These average images were then made symmetrical to emphasize the role of the cues being investigated (see Perrett et al., 1999).

Figure 4.3. Averaged adult images. High (left) and low (right) perceived intelligence male and female facial averages made symmetrical from Study 1. Objective measures show (slightly) more upturned mouth curvature and eyelid-openness in the high-perceived intelligence facial averages images.

4.3.4.2 Correlation matrix

As expected, there was a strong positive correlation between perceived attractiveness and perceived intelligence ($r(100) = 0.72$, $p < 0.001$). Although we would expect a high correlation due to the attractiveness halo itself, this can also lead to concerns about the ability to distinguish these constructs empirically. We addressed this in two ways: (1) to correct the correlation for attenuation (see Chapter 2) due to measurement error, and (2) to establish an indicator of discriminant validity. To address the issue of measurement error Cronbachǿs Alpha reliabilities were calculated for perceived intelligence (*reliability* = 0.98) and perceived attractiveness (*reliability* = 0.98). After correcting for attenuation, the correlation between attractiveness and intelligence ratings rises from $r = 0.72$ to $r = 0.73$, but this increase is not sufficient to undermine their distinctiveness. To establish discriminant validity the differences in correlations between the two physical measures (mouth curvature and eyelid-openness) and the two perceptual ratings (perceived attractiveness and intelligence) were investigated statistically using the Steiger (1980) test for dependent correlations. The correlation between attractiveness and eyelid-openness was significantly different from the correlation between intelligence and eyelid-openness ($rs = 0.18, 0.33$; $z = -2.06$, $p = .039$). Similarly, the correlation between attractiveness and mouth curvature was significantly different from the correlation between intelligence and mouth curvature ($rs = 0.04, 0.24$; $z = -2.68$, $p = .007$) supporting discriminant validity based on objective measures from the target faces. Taken together, these two analyses support the distinction between perceived attractiveness and intelligence measures.

As shown in Table 4.1, measurements of eyelid-openness and eye size were strongly correlated. There was no significant correlation between measurements of mouth curvature and measurements of eyelid-openness or measurements of eye size. There were also moderate correlations between gender[5] of face and perceptual ratings, indicating that female faces were perceived as more attractive and intelligent. However, gender was not significantly correlated with measurements of eyelid-openness, eye size, or mouth curvature. Older individuals tended to have upturned mouth curvature and reduced eye size, but there were no significant correlation between age and eyelid-openness, attractiveness, or perceived intelligence.

Table 4.1
Adult faces: zero-order correlation matrix

	Age	Sex	Perceived Attractiveness	Perceived Intelligence	Eyelid-Openness	Eye Size
Sex	.126	-				
Perceived Attractiveness	-.119	$-.358^{***}$	-			
Perceived Intelligence	.059	$-.373^{***}$	$.719^{***}$	-		
Eyelid-Openness	-.076	.024	.183	$.334^{**}$	-	
Eye Size	$-.321^{**}$	-.074	.191	.160	$.603^{***}$	-
Mouth Curvature	$.205^{*}$	.040	.042	$.237^{*}$	-.003	-.105

$^{***}p < .001$. $^{**}p < .01$. $^{*}p < .05$.

Note: Sex coded as female=1, male = 0. $N = 100$. All tests are two-tailed.

[5] The gender of the face was used as a control throughout the studies because of its influence on perceived intelligence (unlike age). The patterns of findings do not change when not including gender of face as a control.

4.3.4.3 Mediation analysis

To test whether perceived attractiveness mediates the relationship between measurements of eyelid-openness, eye size, mouth curvature, or gender on perceived intelligence[6], the *SPSS* plugin *PROCESS* was used (Hayes, 2013). Given the strong correlation between eyelid-openness and eye size, we initially included these in two separate analyses to avoid potential suppression effects. We also included a third mediation analysis incorporating both variables.

The first mediation analysis conducted (see Table 4.2) examined perceived intelligence as the outcome variable, perceived attractiveness as the mediator, and measurements of eyelid-openness and mouth curvature as independent variables, with gender of face as a control variable. More eyelid-openness and female gender significantly predicted perceived attractiveness, but upturned mouth curvature was not a significant predictor (overall model: $R^2 = 0.17$, $F(3,96) = 6.47$, $p < 0.001$). Perceived attractiveness was a strong predictor of perceived intelligence, yet the direct effects of more eyelid-openness, upturned mouth curvature, and female gender significantly predicted perceived intelligence even with perceived attractiveness in the model (overall model: $R^2 = 0.63$, $F(4,95) = 40.01$, $p < 0.001$). Bias-corrected confidence intervals for indirect effects were calculated through 5000 bootstrap samples. The indirect effect (i.e. the mediation effect through perceived attractiveness) of measurements of eyelid-openness on perceived intelligence was not significant within the 95% CI ($B = 2.33$, $SE = 1.36$, 95% CI [-0.22, 5.14], $\beta = 0.13$), but marginally significant within the 90% CI ($B = 2.33$, $SE = 1.36$, 90% CI [0.22, 4.67], $\beta = 0.13$). The indirect effect of measurements of mouth curvature on perceived intelligence through perceived attractiveness was not significant ($B = 0.60$, $SE = 0.92$, 95% CI [-1.31, 2.36], $\beta = 0.04$).

[6] The variable of age was explored additionally because of the potential effect age can have on eye size and perceptions of naivety. Age was not a significant predictor of perceived intelligence in adults or children (Study 2), and is not included in models for simplicity. Including age in the models does not contribute to the model or change the pattern of results. It is possible that the effects of age on perceptions of intelligence were not significant because the samples in which this potential cue was examined were too narrow in age range.

Table 4. 2

Direct and mediated effects of eyelid-openness, mouth curvature, and gender on perceived attractiveness and perceived intelligence. (see Figure 4.4)

Criterion / Predictors	*B*	*SE*	*CI*	*β*	*p*
Perceived Attractiveness					
Eyelid-Openness	5.32	2.58	0.21 ï 10.44	0.19	0.042
Mouth Curvature	1.37	2.21	-3.02 ï 5.76	0.06	0.536
Gender	-0.56	0.14	-0.84 ï -0.27	-0.73	< 0.001
Perceived Intelligence					
Perceived Attractiveness	0.44	0.05	0.34 ï 0.54	0.61	< 0.001
Eyelid-Openness	4.54	1.28	2.01 ï 7.08	0.23	< 0.001
Mouth Curvature	3.73	1.07	1.60 ï 5.86	0.22	< 0.001
Gender	-0.19	0.74	-0.33 ï -0.04	-0.34	0.013

Note: The overall model, as well as the indirect and direct effects of mediating variables, are described in-text.

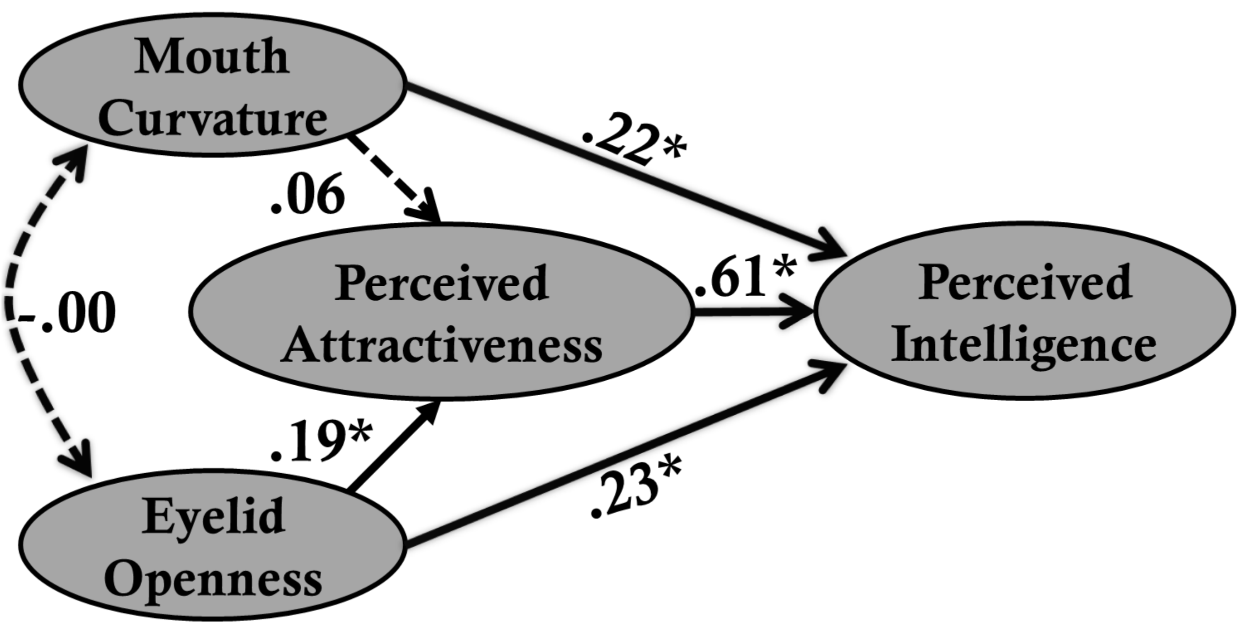


Figure 4.4. Linear regression model for adult faces. This flow chart shows the independent direct effects (β values, * $p < 0.05$) of upturned mouth curvature, eyelid-openness, and attractiveness on perceived intelligence. Gender of face is included in this model, but not displayed (see results for details).

The second mediation analysis (see Table 4.3) examined perceived intelligence as the outcome variable, perceived attractiveness as the mediator, and measurements of eye size (following Cunningham, 1986) and mouth curvature as independent variables, with gender of face as a control variable. Female gender significantly predicted perceived attractiveness, but eye size and upturned mouth curvature were not significant predictors (overall model: $R^2 = 0.16$, $F(3,96) = 6.12$, $p < 0.001$). Perceived attractiveness was a strong predictor of perceived intelligence, yet the direct effects of upturned mouth curvature and female gender significantly predicted perceived intelligence even with perceived attractiveness in the model. The direct effects of larger eye size did not significantly predict perceived intelligence (overall model: $R^2 = 0.58$, $F(4,95) = 32.81$, $p < 0.001$). The indirect effect of measurements of eye size on perceived intelligence (i.e., the mediation effect through perceived attractiveness) was found to be not significant ($B = 31.21$, $SE = 18.68$, 95% CI [-0.96 ï 72.44], $\beta = 0.12$), nor was the indirect effect of measurements of mouth curvature on perceived intelligence through perceived attractiveness ($B = 0.83$, $SE = 0.98$, 95% CI [-1.16, 2.73], $\beta = 0.05$).

Table 4.3
Direct and mediated effects of eye size, mouth curvature, and gender on perceived attractiveness and perceived intelligence.

Criterion / Predictors	*B*	*SE*	*CI*	*β*	*p*
Perceived Attractiveness					
Eye Size	66.92	36.51	-5.55 ï 139.41	0.17	0.070
Mouth Curvature	1.77	2.23	-2.66 ï 6.20	0.07	0.430
Gender	-0.53	0.14	-0.82 ï -0.25	-0.69	< 0.001
Perceived Intelligence					
Perceived Attractiveness	0.47	0.05	0.36 ï 0.57	0.65	< 0.001
Eye Size	13.62	19.02	-24.13 ï 51.37	0.05	0.476
Mouth Curvature	3.76	1.15	1.49 ï 6.04	0.22	0.001
Gender	-0.16	0.08	-0.32 ï -0.01	-0.29	0.042

Note: The overall model, as well as the indirect and direct effects of mediating variables, are described in-text.

The third mediation analysis (see Table 4.4) examined perceived intelligence as the outcome variable, perceived attractiveness as the mediator, and measurements of mouth curvature and *both* eyelid-openness *and* eye size as independent variables, with gender of face as a control variable. Female gender significantly predicted perceived attractiveness, but upturned mouth curvature, larger eye size and more eyelid-openness were not significant predictors of perceived attractiveness (overall model: $R^2 = 0.17$, $F(4,95) = 4.96$, $p = 0.001$). Perceived attractiveness was a strong predictor of perceived intelligence, yet the direct effect of more eyelid-openness significantly predicted higher ratings of perceived intelligence, while there was a trend for the direct effect of larger eye size to be negatively associated with perceived intelligence with perceived attractiveness in the model. Upturned mouth curvature, and female gender also predicted perceived intelligence with perceived attractiveness in the model (overall model: $R^2 = 0.64$, $F(5,94) = 33.22$, $p < 0.001$). The indirect effect of measurements of eyelid-openness ($B = 1.71$, $SE = 1.67$, 95% CI [-1.53, 5.02], $\beta = 0.08$), eye size ($B = 14.93$, $SE = 20.93$, 95% CI [-24.86, 59.43], $\beta = 0.05$) and mouth curvature ($B = 0.70$, $SE = 0.95$, 95% CI [-1.23, 2.56], $\beta = 0.05$) on perceived intelligence (i.e., the mediation effect through perceived attractiveness) were not significant.

Table 4.4
Direct and mediated effects of eye size, eyelid-openness, mouth curvature, and gender on perceived attractiveness and perceived intelligence.

Criterion / Predictors	*B*	*SE*	*CI*	*β*	*p*
Perceived Attractiveness					
Eye Size	33.70	45.95	-57.51 ï 124.91	0.09	0.465
Eyelid-Openness	3.87	3.26	-2.60 ï 10.34	0.14	0.238
Mouth Curvature	1.57	2.23	-2.86 ï 6.01	0.07	0.482
Gender	-0.55	0.14	-0.83 ï -0.26	-0.71	< 0.001
Perceived Intelligence					
Perceived Attractiveness	0.44	0.05	0.35 ï 0.54	0.62	< 0.001
Eye Size	-37.47	22.04	-81.24 ï -6.29	-0.13	0.092
Eyelid-Openness	6.13	1.57	3.01 ï 9.25	0.31	< 0.001
Mouth Curvature	3.50	1.07	1.37 ï 5.62	0.20	0.002
Gender	-0.20	0.07	-0.34 ï -0.05	-0.36	0.009

Note: The overall model, as well as the indirect and direct effects of mediating variables, are described in-text.

4.3.5 Discussion

As expected, there were high correlations between attractiveness and perceived intelligence, reflecting the strength of the attractiveness halo. However, analyses taking into account the attenuation due to measurement error, and correlations demonstrating the discriminant validity of the two constructs support our argument that they can be considered as distinct constructs. This allows us to consider the impact of our other measures of interest on the attractiveness halo effect. Nonetheless, the high correlation does create potential for interpretative difficulties in regression, and under those circumstances we explicitly examine a mediation model that explores their relationship in a way that reflects the traditional understanding of the attractiveness halo. That is, we assumed that perceptions of attractiveness predict perceptions of intelligence, and we examined the direct and indirect effects of our focal and control measures on intelligence, potentially mediated by attractiveness.

The results of Study 1 are consistent with (based on a statistically non-significant trend) Cunninghamȍs (1986) findings of large eyes being positively correlated with attractiveness. We argue that Cunninghamȍs measure of eye size is a compound of two variables: the size of the eyes relative to the size of the face and the openness of eyes. When examined conjointly in regression, neither measure of eye shape significantly predicted attractiveness[7], yet together they did explain a significant portion of variance in ratings of intelligence.

As highlighted by previous research, large eyes are a significant predictor of perceived babyfacedness, which has been shown to cause a baby face overgeneralization effect in which baby-faced individuals are perceived as more naïve (Zebrowitz & Montepare, 1992). When controlling for eyelid-openness and perceived attractiveness in a

[7] It may seem surprising that in the regression model neither eye size, nor eyelid-openness was a significant predictor of attractiveness in adults. The lack of significance of each variable as a predictor does not mean that these variables have no influence. The conjoint contribution of the two eye variables is demonstrable in a hierarchical regression model (1st step independent variables: mouth curvature and sex of face, 2nd step independent variables: Cunninghamȍs eye size and eyelid openness). In the second stage the model showed a significant increase in variance explained by eye size and eyelid openness conjointly (R^2 change = 0.08 p = 0.012). However, their high correlation means that their unique contributions are undermined when both are included in regressions.

linear regression model predicting intelligence, we found a non-significant trend for large eye size to negatively influence perceptions of intelligence.

In contrast, our new measure of eyelid-openness showed that more eyelid-openness increased perceived attractiveness and intelligence. Further, unlike the possible negative effect of large eye size on perceived intelligence, more eyelid-openness led to higher ratings of intelligence above and beyond the attractiveness halo. Likewise, while faces which had a subtly more positive mouth curvature were not perceived as any more attractive, an upturn in mouth curvature was related to a significant increase in perceived intelligence. Hence, the positive effect evident in the mouth configuration appears to have an impact on the attribution of intelligence independent of an attractiveness halo.

These findings suggest that malleable or dynamic facial features have an impact on social attributions: people whose eyelids were more open were perceived as more intelligent than people who had more drooping eyelids. By the same token, people who had more of an upturned mouth curvature (i.e., showed a subtle smile) were not rated as more attractive, but were rated as more intelligent regardless of their attractiveness.

It should be noted that the faces used in this experiment have been used in other studies of social judgments (e.g., Batres & Perrett, 2014; Quist, DeBruine, Little, & Jones, 2012; Re & Perrett, 2012). In all these experiments, the faces were considered to show ñneutralò expressions. The differences in the malleable facial cues of eyelid-openness and upturn in mouth corners need not be based on an overt emotional expression; they could reflect individual differences in anatomy or subtleties in current mood and recent sleep patterns. Subtly upturned mouth curvature and increased eyelid-openness are more visible in the averages of faces judged high on intelligence compared to average of faces judged low on intelligence (see figure 4.3).

Taken together, Study 1 highlights the influence, as well as the subtlety, of the malleable cues of eyelid-openness and mouth curvature on perceptions of intelligence above and beyond the effects of attractiveness. The findings have potential implications in environments in which perceptions of adult intelligence are crucial such as in business, law courts, and higher education. In each of these environments impressions of intelligence may influence expectations about competence. Given the special influence of perceptions of intelligence in education and the particular vulnerability of younger students to the expectancy effect (Alvidrez & Weinstein, 1999; Rosenthal & Jacobson, 1968), Study 2 set out to replicate findings using children as stimuli.

4.4 Study 2: Children's Faces

In order to explore the possible impact upon teacher expectancy effects, we investigated the effect of eyelid-openness and mouth curvature on perceptions of intelligence (and attractiveness) in childrenȏs faces. As in Study 1, all faces showed neutral expressions. It was hypothesized that the influence of expressive features on attributions perceived in adult faces would affect childrenȏs faces equivalently. We thus anticipated that eyelid-openness and upturned mouth curvature would benefit attributions of intelligence beyond attractiveness in childrenȏs faces. Successfully replicating the findings in Study 1 across facial images of school-aged children could have significant implications for educational contexts.

4.4.1 Method

4.4.1.1 Face stimuli

Stimuli consisted of children aged 5 to 16 with 49 boys (M_{age} = 9.38, *SD* = 2.01) and 41 girls (M_{age} = 10.19, *SD* = 2.75). Stimuli pictures were obtained from the Dartmouth Database of Childrenȏs Faces (Dalrymple, Gomez, & Duchaine, 2013). All participants from the database that gave permission to be shared and presented were used as stimuli. All photographs were taken under standardized lighting conditions and camera set-up; individuals wore a black cap, did not wear make-up or jewelry, and posed with a neutral facial expression in front of a black background. As the black cap prevented accurate identification of the hairline, it was not possible to calculate Cunninghamȏs (1986) measurements of eye size which takes into account eye-height in relation to the length of the face. Delineation, alignment, and cropping of the images followed the procedures outlined in Study 1.

4.4.1.2 Validation of perceptual ratings

A total of 16 new participants (15 female, 1 male, M_{age} = 23.1, *SD* = 10.9) were recruited in an online experiment. Seven non-Caucasian participants were excluded but no exclusions were necessary based on standard deviation (all within appropriate range). Participants followed the validation procedures outlined in Study 1. Mouth curvature and eyelid-openness ratings were assessed in two separate blocks. Block and stimulus order were randomized.

Ratings of mouth curvature and eyelid-openness for each face were averaged across all participants and correlated with the measurements of mouth curvature and measurements of eyelid-openness described in Study 1. The measurements of eyelid-openness and perceptual ratings of eyelid-openness were highly correlated ($r(90) = 0.83$, $p < 0.001$). The perceptual ratings of mouth curvature also highly correlated with the objective measurements of mouth curvature ($r(90) = 0.84$, $p < 0.001$).

4.4.2 Participants

4.4.2.1 Intelligence evaluators

After exclusions, a total of 76 new participants (45 female, 31 male, $M_{age} = 34.4$, $SD = 13.90$) were recruited for an online study entitled ñHow Smart Are These Kids.ò Participants were asked to rate childrenôs faces for intelligence. Criteria identical to that in Study 1 were used to exclude participants from the final analysis: three excluded for standard deviation < 0.50 and 14 excluded for not reporting ethnicity as ñwhite Caucasian.ò

4.4.2.2 Attractiveness evaluators

After exclusions, an independent group of 60 participants (27 female, 33 male, $M_{age} = 39.03$, $SD = 11.26$) were recruited for an online study entitled ñChildren Attractivenessò using Amazon Mechanical Turk and participated for payment to rate faces for perceived attractiveness. The same exclusion criteria used for intelligence evaluators was used for attractiveness evaluators. No participants were excluded based on a standard deviation of ratings $< .50$ and 14 participants who reported their ethnicity as different from ñwhite Caucasianò were excluded.

4.4.3 Procedure

As in Study 1, participants completed a questionnaire inquiring about their age, gender, ethnicity, and country of origin. Further, participants followed the procedures of Study 1 previewing stimuli at one second per face prior to the actual rating. The faces were then re-presented with participants using a 7-point Likert-type scale to rate faces for intelligence. An independent group of evaluators rated the stimuli for attractiveness using the same endpoints as those in Study 1. In each experiment, faces were presented in a random order with a minimum response time of one second and no maximum response time.

4.4.3.1 Statistical analysis

An average score of attractiveness and perceived intelligence was calculated for each of the 90 faces based on the average ratings across all participants. Using similar methods following those used in Study 1, a mediation analysis was conducted to explore the direct and indirect effects of measurements of eyelid-openness and mouth curvature on perceptions of intelligence through, and independent of, attractiveness.

4.4.4 Results

4.4.4.1 Facial averaging

Again, face averaging processes outlined in Study 1 were used to synthesize 4 facial averages from the top 10 male and 10 female faces and the bottom 10 male and 10 female faces on rated intelligence (Figure 4.5). These composite images were then made symmetrical to make the investigated cues more salient.

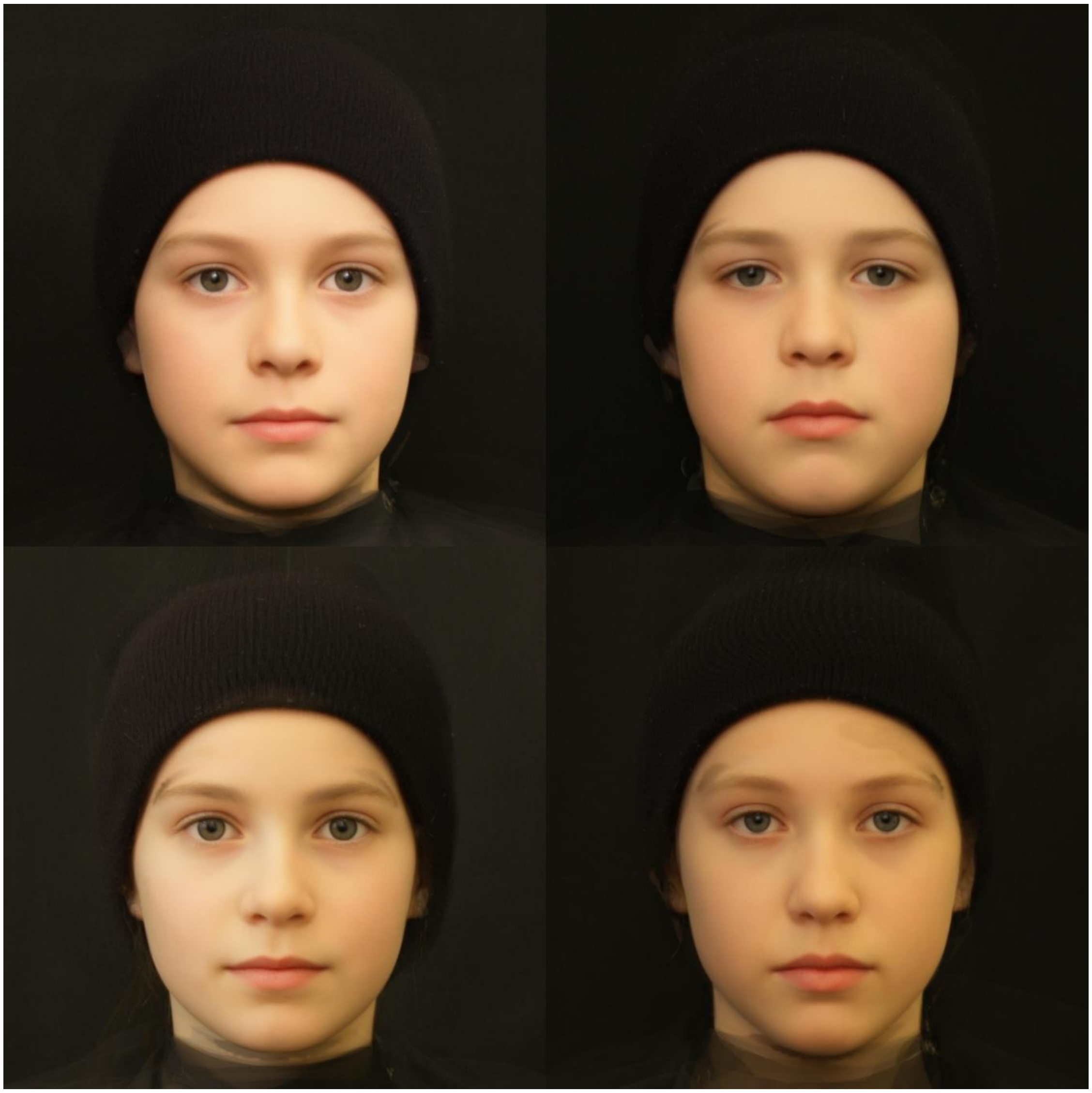


Figure 4.5. Averaged children images. High (left) and low (right) perceived intelligence female (bottom row) and male (top row) facial averages made symmetrical from Study 2. Note the slightly more upturned mouth curvature and greater eyelid-openness in the high-perceived intelligence facial average images.

4.4.4.2 Correlation matrix

As expected, and shown in Table 4.5, there was a strong positive correlation between perceived attractiveness and perceived intelligence. There was also a significant correlation between gender and attractiveness such that female faces were perceived as more attractive and intelligent. Gender was not significantly correlated with measurements of eyelid-openness or mouth curvature. Similar to findings from Study 1, there was no significant correlation between age and eyelid-openness, attractiveness, or perceived intelligence. Unlike the findings from Study 1, there was no correlation between age and mouth curvature. There was no significant correlation between measurements of mouth curvature and measurements of eyelid-openness.

Table 4.5

Children faces: zero-order correlation matrix

	Age	Sex	Perceived Attractiveness	Perceived Intelligence	Eyelid-Openness
Sex	-.168	-			
Perceived Attractiveness	-.022	-.276**	-		
Perceived Intelligence	-.006	-.268*	.856***	-	
Eyelid-Openness	-.155	-.057	.248*	.391***	-
Mouth Curvature	-.038	-.118	.192	.311**	.021

***p < .001. **p < .01. *p < .05.

Note: Sex coded as female=1, male = 0. N = 90. All tests are two-tailed.

4.4.4.3 Mediation analysis

The mediation analysis (see Table 4.6) examined perceived intelligence as the outcome variable, perceived attractiveness as the mediator, and measurements of eyelid-openness and mouth curvature as independent variables, with gender of face as a control variable. More eyelid-openness and female gender significantly predicted perceived attractiveness, but upturned mouth curvature did not significantly predict perceived attractiveness (overall model: $R^2 = 0.15$, $F(3,86) = 5.25$, $p = 0.002$). Perceived attractiveness was a strong predictor of perceived intelligence, yet the direct effects of more eyelid-openness and upturned mouth curvature significantly predicted perceived intelligence with perceived attractiveness in the model. Direct effect of female gender was not significant in predicting perceived intelligence (overall model: $R^2 = 0.79$, $F(4,85) =$

81.05, $p < 0.001$). Bias-corrected confidence intervals for indirect effects were calculated through 5000 bootstrap samples. The indirect effects of measurements of eyelid-openness ($B = 3.96$, $SE = 1.79$, 95% CI [0.50, 7.71], $\beta = 0.19$) on perceived intelligence through perceived attractiveness was significant, but mouth curvature was not ($B = 1.79$, $SE = 1.13$, 95% CI [-0.36, 4.11], $\beta = 0.14$).

Table 4.6

Direct and mediated effects of eyelid-openness, mouth curvature, and gender on perceived attractiveness and perceived intelligence of children's faces. (see Figure 4.6)

Criterion / Predictors	*B*	*SE*	*CI*	*β*	*p*
Perceived Attractiveness					
Eyelid-Openness	5.87	2.53	0.85 ï 10.89	0.23	0.023
Mouth Curvature	2.65	1.67	-0.67 ï 5.98	0.16	0.116
Gender	-0.31	0.13	-0.56 ï -0.06	-0.49	0.017
Perceived Intelligence					
Perceived Attractiveness	0.67	0.05	0.58 ï 0.77	0.77	< 0.001
Eyelid-Openness	4.35	1.14	2.09 ï 6.60	0.20	< 0.001
Mouth Curvature	2.29	0.74	0.82 ï 3.76	0.16	0.003
Gender	-0.03	0.06	-0.14 ï 0.08	-0.05	0.612

Note: The overall model, as well as the indirect and direct effects of mediating variables, are described in-text.

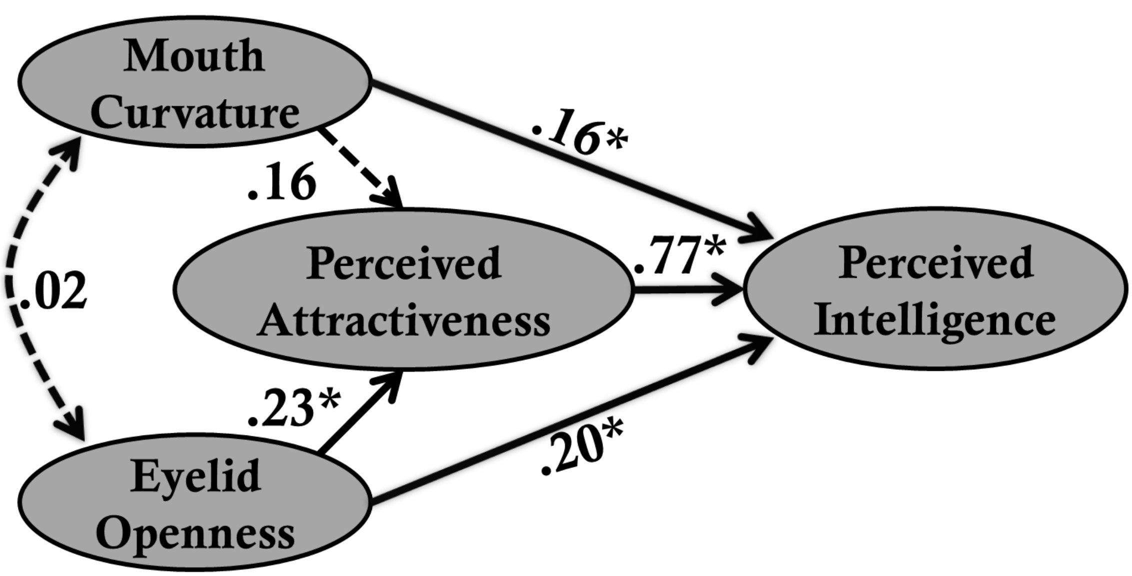


Figure 4.6. Linear regression model of the perception of childrenôs faces. This flow chart shows the independent direct effects (β values, * $p < 0.05$) of upturned mouth curvature, eyelid-openness, and attractiveness on perceived intelligence. Gender of face is included in this model, but not displayed (see results for details).

4.4.4 Discussion

Results of Study 2 replicated the findings of Study 1 with childrenôs faces. As in the adult faces, untrained participants were able to identify subtle differences in eyelid-openness and mouth curvature once their attention was drawn to the possible subtlety of the cues. Thus, objectively measured features were found to be congruent with perceptual ratings, validating the measures used. Further, congruent with findings in adult stimuli, upturn in mouth curvature did not significantly influence perceptions of attractiveness, but did predict increased ratings in perceived intelligence, while increased eyelid-openness had beneficial effects on both attractiveness and perceptions of intelligence. Similarly, as in Study 1 and predicted by the attractiveness halo effect, attractiveness ratings were significantly related to intelligence ratings. Hence, attractiveness mediated some of the beneficial effects of these cues on perceptions of intelligence. Yet, eyelid-openness and mouth curvature predicted ratings of intelligence independent of attractiveness. Thus, malleable facial cues to mood and alertness can have both direct and indirect impact on impressions of intellect.

Taken together, Studies 1 and 2 show that in both adults and children more eyelid-openness and upturned mouth curvature result in higher ratings of intelligence regardless of attractiveness. Most studies of facial attractiveness have investigated the impact of facial traits that are fixed (such as symmetry and averageness) or traits that can change only slowly (age, adiposity, skin texture, and color). Our analysis clearly showed that facial cues that are malleable over short timescales could also impact attributions. Yet, because the cues of eyelid-openness and mouth curvature were investigated across different faces, it is possible that other facial features or a pattern of facial cues may be influencing perceptions of intelligence. Study 3 digitally manipulated stimuli to alter eyelid-openness and mouth curvature cues alone and investigated how these cues can independently influence perceptions of intelligence independent of other facial cues.

4.5 Study 3: Malleable Facial Cues Transform

While Studies 1 and 2 found that the cues of eyelid-openness and mouth-curvature influence perceptions of intelligence across different sets of stimuli, this experiment was designed to investigate whether a targeted manipulation of these specific cues was sufficient to influence perceptions of intelligence. In order to isolate eyelid-openness and mouth curvature as independently predicting perceptions of intelligence, it is important to control for other facial features or a constellation of facial cues that may be influencing perceptions. Using stimuli from Study 2, we digitally manipulated the eyelid-openness and mouth curvature independently to examine whether differences in these cues alone would impact perceived intelligence.

4.5.1 Method

4.5.1.1 Facial stimuli

Forty identities (20 female; M_{age} = 9.90, SD = 2.74; 20 male, M_{age} = 9.83, SD = 2.13) from the Dartmouth Database of Childrenôs Faces (Dalrymple, Gomez, & Duchaine, 2012) described in Study 2, were selected based on gender and similar age. Using Psychomorph, these 40 identities were transformed (50% in both directions) to create a total of 80 stimuli with differences in eyelid openness and mouth curvature. An average was made of the ten faces (out of the original 90 faces described in Study 2) with the most upturned/downturned mouth curvature and increased/decreased eyelid-openness respectively (irrespective of gender). The mouth shape and eyelid-openness of these averages was used to transform the shape of individual faces. The first 20 randomly selected identities were transformed to create 40 stimuli (half of which were female) with different mouth curvature based on the upturned/downturned mouth curvature averages: 20 with an upturned mouth curvature, 20 with a downturned mouth curvature. A further 20 different identities were also transformed to create 40 stimuli with different eyelid-openness: 20 increased in eyelid-openness and 20 decreased in eyelid-openness (see Figure 4.7).

Figure 4.7. Malleable facial cues transform. An average of all childrenŝ faces was manipulated to have increased eyelid-openness (top left) and upturned mouth curvature (bottom left) and decreased eyelid-openness (top right) and downturned mouth curvature (bottom right). The degree of manipulation for this transform was based on a composite image of faces in the set of stimuli with the most and least eyelid-openness and mouth curvature, respectively.

4.5.2 Participants

After exclusions, a total of 37 new participants (7 males, 30 females; M_{age} 21.65, *SD* = 5.12) were recruited to take part in a study entitled ñInfluences in the perception of intelligence in faces ï in lab studyò via SONA, an online research participation system for Psychology studies conducted at the University of St. Andrews and open to the community. Participants were compensated for their time at a rate of £5/hour pro rata. The same criteria as those in previous studies were used to exclude participants from the final analysis, with 23 participants excluded for not reporting ethnicity as ñwhite Caucasianò and no exclusions necessary for standard deviation < 0.50.

4.5.3 Procedure

After completing a short questionnaire inquiring about their age, gender, ethnicity, and country of origin, participants rated the perceived intelligence of stimuli using a 7-point Likert-type scale with endpoints *not at all intelligent* and *very intelligent*. The 80 stimuli were arranged into two blocks, each with 10 upturned mouth curvature, 10 down turned mouth curvature, 10 increased eyelid-openness, and 10 decreased eyelid-openness. Each block contained 40 unique identities, i.e., no identity was repeated within one block so that each manipulation was done on a different identity and evaluators would not be presented with the same identity manipulated in different ways in the same block. Across the two blocks the only thing in the facial image to change was the upturn/downturn mouth curvature or the increase/decrease in eyelid-openness. Stimuli were standardized identical to that of Study 2: standardized lighting, black background, black caps, no make-up or jewelry, neutral expression and head posture.

4.5.4 Results

A one-way repeated measures ANOVA showed that the difference in intelligence ratings for stimuli with increased eyelid-openness (*M* = 4.15, *SD* = 0.60) and decreased eyelid-openness conditions (*M* = 4.08, *SD* = 0.51) was statistically significant, *F* (1,35) = 12.82, *p* = .001, partial η^2 = .268. Similarly, a one-way repeated measures ANOVA showed that the difference in intelligence ratings for stimuli with upturned mouth curvature (*M* = 3.98, *SD* = 0.63) and downturned mouth curvature conditions (*M* = 3.79, *SD* = 0.60) was statistically significant, *F* (1,35) = 4.48, *p* = .042, partial η^2 = .113. There were no significant interactions for face gender with eyelid-openness (F (1,35) = .204, p = .654) nor with mouth curvature (F (1,35) = .761, p = .389).

4.5.5 Discussion

The results of Study 3 emphasize the role of eyelid-openness and mouth curvature influencing perceptions of intelligence independent of any other fixed facial features or combination of facial features. Given that the facial transforms were made from natural variation in neutral resting expressions, it is evident that even the slightest differences in eyelid-openness and mouth curvature can significantly impact social judgments (see Figure 4.7). Study 1 and 2 found that differences in eyelid-openness and mouth curvature across individuals can influence perceptions of intelligence, while Study 3 found that when these cues alone (through digital manipulation) are changed within the same facial image there is an impact on perceived intelligence.

The findings of Study 3 are limited to single images of people and stimuli that have been digitally manipulated to change targeted cues. To confirm whether changes in appearance of real people have an impact on attributions, Study 4 compared different images of the same person and investigated whether a natural change in facial cues can lead to a change in trait attributions. That is, Study 4 attempts to improve the ecological validity and overall generalizability of findings by examining whether natural changes in eyelid-openness and mouth curvature within the same person alter perceived intelligence.

4.6 Study 4: Sleep-Restricted Faces

To investigate the effect of malleable cues to perceived intelligence within the same stimuli, we had participants rate the perceived intelligence and attractiveness of two facial images of the same person taken under separate conditions: after normal sleep and after sleep restriction. We expected that sleep restriction would be associated with negative mood manifested in a more downturned mouth configuration, and increased tiredness manifested in reduced eyelid-openness (Sundelin et al., 2013). We further predicted that changes in these facial features would impact perceptions of intelligence. A set of raters was then asked to choose which face had more eyelid-openness and was smiling more when comparing the two images of the same person taken under the two separate conditions. Hence, while Studies 1 and 2 showed that eyelid-openness and mouth curvature across individuals significantly influence perceptions, Study 4 investigated whether these effects are evident within the same person.

4.6.1 Method

4.6.1.1 Face stimuli participants

The stimuli pictures presented in this experiment came from the Sleep, Cognition, and Health Lab at Karolinska Institutet in Stockholm, Sweden. Specifically, 25 individuals (14 females) were recruited and then photographed in two separate conditions: baseline and sleep restriction. A series of photographs were taken at each occasion with a standardized camera set up. Participants had their hair pulled back, no make-up or jewelry, and were asked to maintain a neutral facial expression. Five to eight representative photographs from each photo shoot were selected after low-quality photos (e.g., participant blinking) had been removed. A final selection ñof the most representative photoò was done by an independent judge unaware of the experimental design or the sleep condition of the person in the photos. The judge was instructed to choose the photo out of the five to eight available pictures that looked the most like the other photos taken at the same time. The individual judge did not know the participants in the photos. Todorov and Porter (2014) highlight significant differences in person impressions within multiple facial photos of the same person due to random variation and discuss how this can influence accuracy of personality inferences based on faces. Thus, it was important to select the most standardized stimuli.

These photographs were used for ratings in the second part of the study. The stimuli originally consisted of a total of 50 facial images from the two separate conditions (baseline and sleep-restricted), but one female was excluded prior to ratings for not having her hair properly combed back and another two female faces were excluded after ratings because of open mouths or exaggerated smiles (relative to the other stimuli), leaving the total number of stimuli at 44 facial images (11 females, 11 males, M_{age} = 22.9, SD = 3.33).

4.6.1.2 Sleep-restriction procedures

Participants had a sleep need of seven to nine hours a night with no reported health problems or sleep disturbances. Participants (for stimuli) came into the lab on two separate occasions in a counter-balanced order; after spending at least eight hours a night in bed for two consecutive nights, and after spending no more than four hours a night in bed for two consecutive nights. The lab visits were at least one week apart. Adherence to the protocol was controlled via actigraphs (a small accelerometer worn on the non-dominant arm measuring activity and giving good information about sleep duration), sleep diaries, and text messages sent to the investigator at lights off and waking.

4.6.1.3 Validation of objective measures of feature changes

The purpose of this additional validation was to assess whether evaluators were capable of detecting a change in eyelid-openness and mouth curvature between sleep restriction conditions and whether these assessments matched objective measurements of eyelid-openness and mouth curvature. Studies 1 and 2 examined subtle differences in eyelid-openness and mouth curvature between different individuals. Study 4 enabled us to use pairs of facial images of the same individual to examine a more sensitive forced-choice paradigm to explore perceptions of these facial features.

After exclusions, a total of 90 new participants (67 female, 23 male, M_{age} = 27.3, SD = 11.10) were recruited in an online study. Thirteen non-Caucasian participants and 22 participants who spent less than one second looking at an image were excluded. Participants completed a forced-choice experiment to compare the eyelid-openness and mouth curvature of the same person, between conditions. Specifically, participants were shown two images of the same face side-by-side, (baseline and sleep restricted) and were asked to ñPlease click on the face that is smiling moreò or ñPlease click on the face that has its eyelids more openò in two separate blocks. Each participant completed both blocks (22 trials each block) and the order of blocks and stimulus faces was randomized.

Perceptual evaluations of eyelid-openness and smiling were calculated as the total count of observers choosing one face image over the corresponding face image from the alternative condition. This total count was then divided by the total number of observers (90 participants). This proportion defined perceptual evaluation of each face, which was then compared to the change in measurements of eyelid-openness and mouth curvature between conditions. In a partial correlation controlling for the age and gender of the face, the perceptual evaluation of eyelid-openness was positively correlated with the measured change in eyelid-openness ($r(20) = .62$, $p = 0.003$) and the perceptual evaluation of smiling was significantly correlated with the measured change in mouth curvature ($r(20) = 0.82$, $p < 0.001$) across the conditions. Thus, the malleable cues were indeed evident to observers and understood in a way that is consistent with the interpretation given to the objective measures.

4.6.2 Participants

4.6.2.1 Attractiveness and intelligence raters

After exclusions, a total of 61 participants (30 females, 30 males, 1 of unspecified gender, $M_{age} = 25.9$, $SD = 6.10$) rated 48 facial photographs with respect to attractiveness and intelligence. Participants were recruited at Universities and a work place in the Stockholm area and received a movie ticket for their participation. Participants who did not speak Swedish, were younger than 18, older than 45, or students of psychology were not recruited. No exclusions were necessary based on the same criteria used to exclude participants in previous studies (i.e., ethnicity and standard deviation of ratings).

4.6.3 Procedure

Participants rated 48 facial images for perceived intelligence and attractiveness. As part of a larger data collection, facial images were also rated for perceived tiredness, leadership ability, trustworthiness, and employability. The first four blocks of ratings were in a randomized order and consisted of intelligence, trustworthiness, leadership ability, and employability. After that, attractiveness and tiredness were rated, in that order. After a short test trial of four photos to familiarize the participants with the procedure, the photos were presented one-by-one and rated on 7-point Likert-type scales from 1 (*not at all intelligent or very unattractive*) to 7 (*very intelligent or very attractive*). The photographs were shown at a self-paced interval, for a maximum of six seconds. The presentations were made in a randomized order, with the exception that the two photographs from the same person (one from each condition) could not be presented back to back. After every 48th photograph, the participants performed a working memory task to prevent memorization of the faces and to avoid a familiarity effect.

4.6.3.1 Statistical analysis

The ratings of attractiveness and intelligence for each face were averaged across raters and were then separated by condition. To examine the within-subject differences in eyelid-openness and mouth curvature pre- and post-sleep restriction, the change in ratings for the same face but different condition was computed (averaged baseline ratings subtracted by averaged sleep restricted ratings). This change of ratings between conditions was then compared to the measurements of change (baseline subtracted by sleep restriction) in eyelid-openness and mouth curvature across the 2 conditions. Gender was included as an individual level factor. To remain consistent with previous data analysis strategies, mediation analysis was conducted to examine the direct and indirect effects of the change in measurements of eyelid-openness and mouth curvature on change in perceived intelligence. However, because this is a within subject design with a small sample examining whether a change in malleable facial cues can change perceptions of intelligence within the same person, we were less concerned with whether this effect happened through or independent of the change in attractiveness and instead examined the total effects of these facial cues on the overall change in perceptions of intelligence.

4.6.4 Results

4.6.4.1 Facial averaging

Again, described effects are visualized using the face averaging process explained in Study 1. Facial averages were synthesized from the top 10 male and female (n = 20) and the bottom 10 male and female (n = 20) faces; this time based on *change* in perceived intelligence within the same individual, rather than *average* perceived intelligence across individuals (see Figure 4.8).

Figure 4.8. Averaged sleep-restriction images. High (left) and low (right) perceived intelligence male and female facial image averages from Study 4. There seems to be slightly more upturned mouth curvature and eyelid-openness in the high-perceived intelligence (left) facial composite images.

4.6.4.2 Sleep condition

Pre- and post-sleep restriction measurements of eyelid-openness and mouth curvature, along with ratings of attractiveness and perceived intelligence, were compared to investigate whether the condition of sleep restriction influenced any of these variables. Paired-samples t-tests were used to compare measures and ratings across conditions (baseline vs. sleep restricted). For eyelid-openness, there was a significant difference in the scores for baseline ($M = 0.12$, $SD = 0.02$) and sleep restricted ($M = 0.11$, $SD = 0.02$) conditions; $t(21) = 3.16$, $p = 0.005$. The mean difference in eyelid-openness was 0.01 (95% [0.00, 0.01]) demonstrating a medium effect size, d = 0.67. For mouth curvature, there was not a significant difference in the scores for baseline ($M = 0.00$, $SD = 0.03$) and sleep restricted ($M = -0.01$, $SD = 0.03$) conditions; $t(21) = 1.43$, $p = 0.169$. For attractiveness, there was a significant difference in the scores for baseline ($M = 3.62$, $SD = 0.76$) and sleep restricted ($M = 3.48$, $SD = 0.82$) conditions; $t(21) = 2.70$, $p = 0.013$. The mean difference in attractiveness was 0.14 (95% [0.25, 0.33]) demonstrating a medium effect size, d = 0.58. For perceived intelligence, there was a non-significant trend for a difference in the scores for baseline ($M = 4.46$, $SD = 0.59$) and sleep restricted ($M = 4.38$, $SD = 0.61$) conditions; $t(21) = 1.82$, $p = 0.083$. While the mean ratings did not differ significantly between conditions, it is possible, nonetheless, for changes in eyes and mouth to underlie changes in ratings across the two conditions.

4.6.4.3 Correlation matrix

As expected, there was a strong positive correlation between change in perceived attractiveness and change in perceived intelligence ($r(22) = 0.75$, $p < 0.001$). There was no significant correlation between gender of face (female coded as 0) and average perceived attractiveness ($r(22) = -0.06$, $p = 0.781$) or perceived intelligence ($r(22) = -0.13$, $p = 0.574$). There was also no significant correlation between age of face and perceived attractiveness ($r(22) = 0.07$, $p = 0.768$) or perceived intelligence ($r(22) = -0.06$, $p = 0.776$). There was also no significant correlation between change in measurements of mouth curvature and change in measurements of eyelid-openness ($r(22) = 0.10$, $p = 0.666$).

4.6.4.4 Mediation analysis

The mediation analysis (see Table 4.7) examined change in perceived intelligence as the outcome variable, change in perceived attractiveness as the mediator, and change in measurements of eyelid-openness and measurements of mouth curvature as independent variables, with gender of face as a control variable. Neither gender, change in more eyelid-openness, nor change in upturned mouth curvature were significant predictors of change in perceived attractiveness (overall model: $R^2 = 0.20$, $F(3,18) = 1.46$, $p = 0.258$). Change in perceived attractiveness was a strong predictor of change in perceived intelligence, yet the direct effects of change in upturned mouth curvature significantly predicted perceived intelligence with perceived attractiveness in the model. The direct effects of more eyelid-openness and gender were not significant predictors of change in perceived intelligence (overall model: $R^2 = 0.76$, $F(4,17) = 13.48$, $p < 0.001$). Bias-corrected confidence intervals for indirect effects were calculated through 5000 bootstrap samples. The indirect effects of change in measurements of eyelid-openness ($B = 2.78$, $SE = 2.71$, 95% CI [-2.24, 8.75], $\beta = 0.19$) and mouth curvature ($B = 1.37$, $SE = 1.11$, 95% CI [-0.68, 3.78], $\beta = 0.19$) on perceived intelligence through perceived attractiveness were both not significant.

However, the total effect of change in more eyelid-openness ($B = 6.34$, $SE = 3.01$, 95% CI [0.12, 12.67], $p = 0.050$, $\beta = 0.36$) and change in upturned mouth curvature ($B = 4.79$, $SE = 1.32$, 95% CI [2.02, 7.56], $p = 0.002$, $\beta = 0.60$) on change in perceived intelligence was significant (overall model: $R^2 = 0.51$, $F(3,18) = 6.33$, $p = 0.004$).

Table 4.7

Direct and mediated effects of change in eyelid-openness, change in mouth curvature, and gender on changes in perceived attractiveness and perceived intelligence of adult faces with and without sleep restriction. (see Figure 4.9)

Criterion / Predictors	*B*	*SE*	*CI*	*β*	*p*
Perceived Attractiveness					
Eyelid-Openness	5.44	4.20	-3.40 ï 14.27	0.28	0.212
Mouth Curvature	2.68	1.84	-1.18 ï 6.55	0.31	0.162
Gender	0.10	0.10	-0.12 ï 0.32	0.41	0.356
Perceived Intelligence					
Perceived Attractiveness	0.51	0.12	0.25 ï 0.77	0.55	< 0.001
Eyelid-Openness	3.57	2.27	-1.23 ï 8.37	0.20	0.135
Mouth Curvature	3.42	1.01	1.30 ï 5.54	0.43	0.003
Gender	0.01	0.06	-0.11 ï 0.13	0.05	0.846

Note: The overall model, as well as the indirect and direct effects of mediating variables, are described in-text.

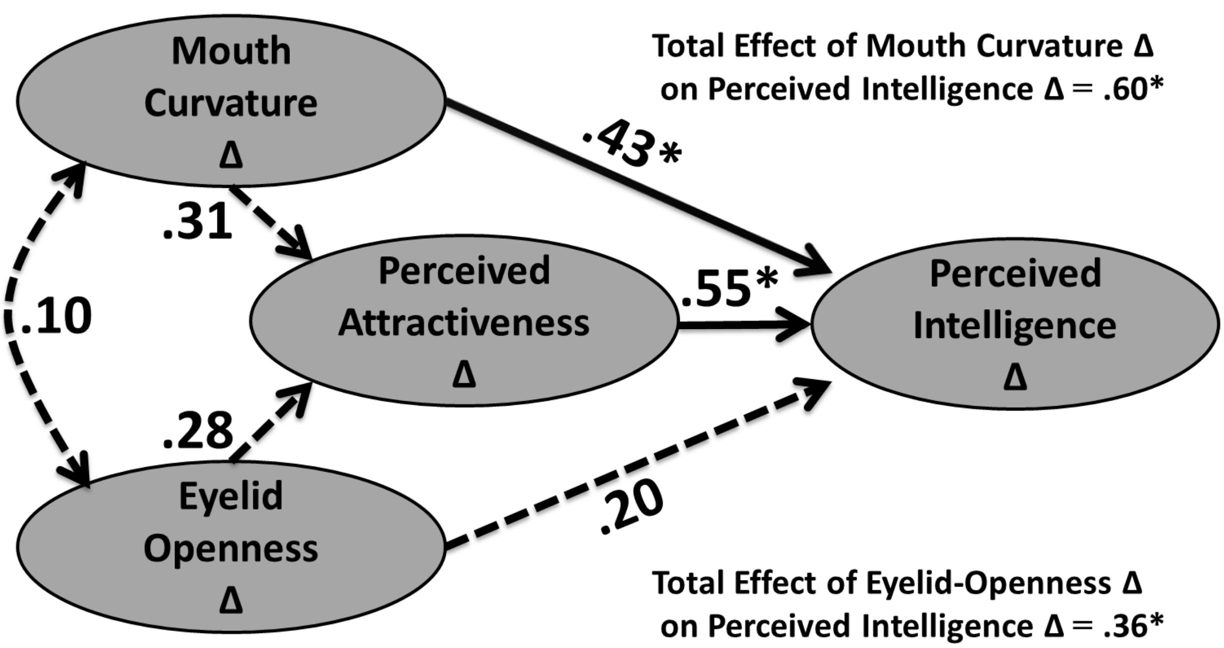


Figure 4.9. Linear regression model of the perceptual effects of sleep restriction. This flow chart shows the standardized independent direct effects (β values, * $p < 0.05$) of change in mouth curvature and change in eyelid-openness on change in perceived attractiveness and intelligence. Gender of face is included in this model, but not displayed (see results for details).

4.6.5 Discussion

Study 4 focused on how malleable cues influence perceived attractiveness and intelligence in the same person rather than across different individuals (Studies 1 and 2). The findings suggest that the malleable cues of smiling and eyelid-openness do influence perceptions of intelligence in the same person regardless of the effect of sleep condition on these cues. Interestingly, there was no significant relationship between change in eyelid-openness and smiling on perceived attractiveness, yet both malleable facial features had an influence on the change in perceived intelligence. The importance of smiling perception is apparent from the finding that images with a more upturned mouth curvature were perceived as more intelligent, independent of the impact of the attractiveness halo. Hence, regardless of fixed facial traits (such as averageness, symmetry, gender, and age), malleable cues can alter perceptions of intelligence.

Study 4 also examined the role of sleep restriction on attributions to faces and malleable facial features. It was found that sleep restriction was associated with people having less eyelid-openness, but sleep restriction was not associated with a change in mouth curvature. This gives objective support to the finding that sleep deprived people are perceived as having more heavy eyelids, but contrasts the finding that sleep deprived people are also judged to have more droopy mouth corners (Sundelin et al., 2013). We note that the previous study on this had a more severe form of sleep deprivation, and the degree of sleep deprivation may influence the effects on mouth curvature. Regardless, the change in mouth curvature from one photographic condition to another was significantly associated with perceptions of intelligence. That is, when comparing two images of the same person, the image with the more positive mouth curvature looks more intelligent. Thus, smiling is such a controllable cue that even people who are sleep deprived can be perceived as more intelligent (compared to a rested state) if they exhibit the subtlest upturn in mouth curvature.

Taken together, the findings of Study 4 suggest eyelid-openness and mouth-curvature can subtly change within the same person and that these changes are perceivable and influence attributions of intelligence accordingly. Specifically, when a face had more eyelid-openness and more upturned mouth curvature, that face was perceived as more intelligent compared to an alternative facial image of the same person with less eyelid-openness and more downturned mouth curvature. Some fixed facial attributes such as averageness, sexual dimorphism, and skin pigment evenness affect facial attractiveness and may affect attribution of traits including intelligence. We have argued that malleable facial cues also have a role in attributions, but the degree of eyelid-openness and mouth curvature can also differ anatomically between individuals; one individual may on average have more droopy eyelids than another individual independent of the sleep habits of the two. All of these fixed traits may have a role in attributions made from facial appearance and could contribute to ratings in Studies 1 and 2. Studies 3 and 4 provide much more direct evidence that facial features changing within an individual can have effects on attributions of intelligence.

4.7 General Discussion

The aim of the presented studies was to introduce and validate new measures to investigate malleable cues to perceptions of intelligence that are independent of the attractiveness halo. The cues of eyelid-openness and mouth curvature were targeted because of their likely relationship to sleep-deprivation and low mood, both of which have been associated with decreased cognitive ability (Ellis et al., 1984; Thomas et al., 2000). Our findings supported the hypothesis that more eyelid-openness and upturned mouth curvature increase ratings of perceived intelligence independent of attractiveness across adult faces (Study 1), childrenôs faces (Study 2), and even within the same individualôs face (Studies 3 and 4). We have focused on generalizability of the effect across ages and within the same person, and while we expect that the general point we are making would apply to other-race faces, we have limited our sample here for control purposes. The generalizability of the effects across races will need to be established in the future with a broader sample of faces and raters.

4.7.1 Attractiveness

Given the strength and pervasiveness of the attractiveness halo, it was important to determine whether the effects of the investigated cues stem from overgeneralizations of conditions that limit cognitive performance (i.e., alertness and mood) or only influence perceptions of intelligence through their impact on perceived attractiveness. It is clear from our findings that while the attractiveness halo is robust, there are certain malleable facial cues that can be changed to make it more likely that someone will be perceived as more or less intelligent regardless of their physical attractiveness.

4.7.2 Overgeneralizations

The beneficial impact of eyelid-openness and upturned mouth on perception of intelligence are likely to reflect overgeneralizations. Tiredness (Thomas et al., 2000; Walker, 2009) and low mood (Ellis et al., 1984) detract from current cognitive ability. Evaluators may therefore generalize from cues to tiredness and poor mood to the trait of intelligence; someone who looks awake and happy is thought to be more intelligent than someone who looks tired and unhappy. Overgeneralizations from mouth shape to emotional state has been previously suggested to underlie social attributions (Oosterhof & Todorov, 2008). Our findings suggest overgeneralizations arise from the eyes as well as the mouth. Moreover, we show that both face cues are detected by observers and can be objectively measured in images.

4.7.3 Mouth curvature

The shape of the mouth (expressing a subtle smile or frown) is a malleable facial cue that does not necessarily seem to influence perceived attractiveness across adult faces (Study 1) but does increase attractiveness in childrenꞌs faces (Study 2) and significantly influences perceptions of intelligence in both adults (Study 1) and children (Study 2). It was also shown that a positive change in mouth curvature (more smiling) results in an increase in perceived intelligence ratings independent of other facial cues (Study 3) and within the same person (Study 4).

While the mouth curvature is so subtle that the facial expressions seem neutral (see Figures 3, 4, and 5), our findings suggest that observers are able to detect these subtle differences in mouth curvature and that these differences influence perceptions of intelligence accordingly. The reason smiling influences perceptions of intelligence above the attractiveness halo may be an overgeneralization effect related to sad mood and its effect in reducing cognitive performance (Ellis et al., 1984) or subtle frowning may indicate tiredness, which is related to worse cognitive functioning (Thomas et al., 2000; Walker, 2009).

More generally however, the finding that subtle cues may impact trait ratings has important implications. Oosterhof and Todorov (2008) argue that impressions of emotional valence in ñneutralò faces can affect trait judgments. While the stimuli faces in the current study did not seem to be smiling overtly or noticeably to the participants, a positive mouth curvature could enhance judgments of attractiveness and perceived intelligence and conversely subtle frowns could have adverse effects on trait evaluation. Further, it could be argued that unintentional smiles are a reflection of mood (i.e., a better mood might be accompanied by a subtle smile). Based on findings that a sad mood is associated with reduced cognitive performance (Ellis et al., 1984), signs of mood could potentially be a reflection of current cognitive capacity.

These results are important to consider in future studies where experimenters may assume facial stimuli to be ñneutralò. Differences in mouth curvature, which observers do not report as differences in smiling, seem to affect perceptions of intelligence. Indeed, measurements of mouth curvature may reveal effects on a variety of different social judgments of faces (e.g., perceived dominance, trustworthiness, etc.).

4.7.4 Eyelid-openness

Eyelid-openness is another malleable facial cue that influences perceived intelligence independent of the attractiveness halo. The impact of eyelid-openness was observed both across faces of different people (Study 1 and 2) and within the face of the same person (Study 3 and 4). Observers validated the measurements used to calculate eyelid-openness variation across the faces of different people (adults and children) and within the face of the same person across two different conditions (Study 4).

It could be argued that although eyelid-openness is not fixed, oneøs ability to change eyelid-openness is less controllable than oneøs ability to control mouth shape. While attempting to increase eyelid-openness (to look more alert or intelligent) is possible, it is difficult to do so without moving the eyebrows and looking surprised or unnatural. Perhaps unsurprisingly, results indicated that sleep restriction reduced eyelid-openness which was in turn detrimental to ratings of perceived intelligence.

We also found that in line with Cunninghamøs (1986) earlier findings, measurement of eye size correlated positively with ratings of attractiveness. However, when controlling for attractiveness and eyelid-openness, the neotenous fixed trait of large eyes is perceived as less intelligent, congruent with the baby-faced overgeneralization effect. Hence, while large eyes may positively influence attractiveness, large eyes relative to the size of the face can decrease rather than augment perceived intelligence. Further, the difference in direction between the effects of eyelid-openness and eye size on perceptions of attractiveness and intelligence points to the distinction between the perceived attractiveness and intelligence constructs despite their high correlations with each other.

4.7.5 Gender

Gender of the face was included as a factor in the analyses in order to control for any effects it may have on eye size and independent influences it may have on perceptions of intelligence. In adultsô (Study 1) and childrenõs (Study 2) faces, gender of the face significantly influenced perceptions of intelligence independent of attractiveness; females were judged to look more intelligent than males. These findings conflict with previous literature that finds females are perceived as less intelligent than males (Beloff, 1992; Byrd & Stacey, 1993). Specifically, Furnham and Rawles (1995) found that both men and women rate their fathers as having higher intelligence than their mothers and rated their grandfatherõs intelligence higher than their grandmotherõs intelligence. Additionally, previous research has also highlighted that parents think their sons are brighter than their daughters (Furnham et al., 2002).

Such perceptions may be outdated as there is increasing evidence that women do better academically than men (Gurian & Stevens, 2004). Gender was primarily included in our analyses as a control to the effects on the facial cues investigated. More research into the characteristics of the raters is needed to establish whether our findings represent a potential societal shift in perceptions of womenõs intelligence relative to men.

4.8 Conclusions and Implications

We have documented two malleable facial cues that influence first impressions and may create an expectancy effect. We find that there is a strong relationship between the cue of eyelid-openness and perceptions of both attractiveness and intelligence, yet this cue has been largely overlooked in literature on social perception of faces. Further, we find mouth curvature in faces with a neutral expression have a pronounced influence on perceptions of intelligence. We show the effects of mouth curvature and eyelid-openness on facial perception is widespread, influencing intelligence judgments in adults and children alike.

The judgments of attractiveness and competence have a broad range of implications influencing perceptions of success (Rule & Ambady, 2010), hiring and promotion (Rule & Ambady, 2009), and mate selection (Eagly et al., 1991; Moore et al., 2011). The implications for children are perhaps most important. Children arriving at school tired from inadequate sleep or in low mood due to adverse home life are likely to be judged as less intellectually able. In turn these judgments are likely to lower teacher expectations and hinder educational attainment (Rosenthal & Jacobson, 1968). Yet, we show that the cues on which intelligence judgments hinge are changeable. Hence, improvements in sleep patterns and mood for any individual may benefit social evaluations and expectations. The subtlety of the cues studied here means that the role of malleable facial features in society and their influence in diverse situations, such as in the formation of teacher expectations and employee recruitment, is likely to have been underestimated.

Chapter 5: Own Intelligence and Endorsement of the Intelligence-Attractiveness Halo

This chapter is based on research that is under peer-review in an academic journal:

Talamas, S.N., Mavor, K. I., & Perett, D. I. (in revision). Own intelligence and endorsement of the intelligence-attractiveness halo.

5. Abstract

While some theories emphasize the influence of the ñattractiveness haloò on perceptions of intelligence, there is also evidence which suggests that perceptions of attractiveness themselves can be influenced by perceptions of other desired traits such as intelligence. In an educational context, the effect of impressions of intelligence on teachersô expectations of students gives them particular significance. Research on kin selection and cognitive biases highlights the possibility that intelligent people endorse the intelligence-attractiveness relationship more strongly than less intelligent people. We investigated how a perceiverôs own intelligence can influence the association between perceived intelligence and attractiveness of others. We asked 126 participants to rate 48 childrenôs faces for perceived intelligence and attractiveness and then asked them to complete the International Cognitive Ability Resource (ICAR) intelligence test. Ratings by participants who scored higher on the intelligence test showed a stronger relationship between perceptions of intelligence and attractiveness than participants who scored lower on the intelligence test. This effect was significant even after controlling for differences in participantsô scale use, i.e., controlling for *SD* and *M* of ratings of attractiveness and perceived intelligence. These findings, while preliminary, illuminate an individual difference that influences perceptions of intelligence with potentially concerning implications regarding expectancy effects in educational settings.

5.1 Introduction

The widely studied halo effect suggests that certain traits function as a metaphorical halo, casting an overly positive light on other traits. Thorndike (1920) defined the halo effect as a tendency to form a general evaluation of someone as good or bad and to base future judgments of a person based on this general feeling. In a comprehensive analysis of the halo effect, Asch (1946) asserted that impression formation of individuals involves a holistic process of attempting to form an impression of the *entire* person, based on dynamic interactions of various traits, rather than isolated traits forming the impression of a *part* of a person. In turn, the halo effect can lead to *general* impression formation, centered on insufficient or *limited* information relying on isolated traits.

The halo effect has been studied extensively in the context of education because of the influence that general impressions may have on expectations of students (Rosenthal & Jacobson, 1968) and the consequences of expectancy effects on student performance (de Boer, Bosker, & van der Werf, 2010; see Chapter 3). This study further explores the halo effect by investigating the influence that oneĝs own intelligence may have on the degree to which an individual endorses the intelligence-attractiveness relationship in facial images of children. It is useful to recognize the various potential origins of the intelligence-attractiveness halo to understand the potential role of own intelligence as an individual difference related to the endorsement of the intelligence-attractiveness association.

5.1.1 Individual differences

The difference in an individualĝs inclination to rate a childĝs face that is perceived to be intelligent as attractive can be interpreted as either: being more susceptible to the attractiveness halo or having a stronger preference (reflected in higher ratings of attractiveness) for intelligent looking faces. Many studies address the question of attractiveness in the context of theories of assortative mating and mate value (see Chapter 3). Yet, a number of the findings can be interpreted more broadly in terms of preferences for similar others. We therefore briefly consider these findings with that broader interpretation in mind. Carter and Glick (1976) suggested that couples select for similarity and argued against the idea that ñopposites attractò. The tendency to seek out those similar to oneself in regards to intelligence (Jensen, 1978; Price & Vandenberg, 1980; Reynolds et al., 2000; Vandenberg, 1972) and educational achievement (Mare, 1991) has yielded consistently positive results. Furthermore, significant positive correlations between spousesô mental abilities have been found to exist even after controlling for socioeconomic status and education (Watkins & Meredith, 1981).

Reciprocally, research has also shown that individual preferences for certain personality traits in others can influence ratings of facial attractiveness (Little, Burt, & Perrett, 2006). That is, if individuals prefer a particular trait, they might consider faces they perceive as having that trait as more attractive than other faces (Little et al., 2006). For example, a person who admires the importance of hard work may find a face that they deem to look hard working as being more attractive. Further, while previous research suggests people may estimate personality from faces with some accuracy (Penton-Voak, Pound, Little, & Perrett, 2006), Little et al., (2006) found that *perceptions* of personality alone can influence attractiveness and that people who consider a particular personality preferable will have different perceptions of attractiveness based on that liking. Such differences in the *perception* of preferred traits influencing attractiveness may extend to the *perception* of intelligence, such that those who are more intelligent value intelligence more as a trait and thus perceive faces that are intelligent as more attractive.

Indeed, it has been argued that, given sufficient time, people are more likely to rely on relevant information about personality or ability to form impressions of others, rather than attractiveness (Campbell, 1979; Eagly et al., 1991; Felson & Bohrnstedt, 1979; Gross & Crofton, 1977; Owens & Ford, 1978). Further, previous research has found that non-physical factors (e.g., information about personality, previous academic achievement) can have a significant influence on perceptions of attractiveness (Kniffin & Wilson, 2004; Zhang et al., 2014). The current study did not examine the direction of the perceived intelligence-attractiveness relationship or the influence of context (i.e., information about the perceived stimuli) on attributions, but focused on individual differences that may be associated with a stronger tendency to rate a child perceived as intelligent also as more attractive. We explore the theories of kin selection and anchoring effects that may explain the potential for individuals who score higher on an intelligence test to find faces of children perceived to be intelligent as more attractive than children perceived to be unintelligent.

5.1.2 Kinship

While assortative mating highlights the tendency for people to choose mates based on similarities, kin selection proposes that individuals will help others in a manner proportionate to genetic similarity (Hamilton, 1964). Nepotism would suggest we favor individuals most similar to us because of the likelihood of kinship (Alexander, 1979). Phenotype matching is one mechanism of kin recognition; an organism can learn their own phenotype and/or those of their familiar kin and later use this learned template in matching the self with the phenotypes of unknown individuals (Holmes & Sherman, 1982; Lacy & Sherman, 1983). Indeed, DeBruine (2002) found that people are more altruistic towards self-resembling individuals, even when this resemblance is very subtle. While Bressan and Martello (2002) found that similar looking individuals are often considered more likely to be genetically related than dissimilar looking people, they also found that belief in genetic relatedness (compared to actual genetic relatedness) was a stronger predictor of perceived similarity. While facial similarity is one mechanism of phenotype matching, belief in genetic relatedness may also stem from similarity on other heritable traits, like intelligence.

It might be considered surprising that similarity would be attractive if it is a cue to kinship, since people are generally averse to sexual relations with kin. A closer examination of the similarity-attraction effect reveals that similarity does not necessarily imply sexual attraction, but rather the liking of another person (Park, Schaller, & Van Vugt, 2008). Thus, people who score higher on intelligence tests may find perceived intelligence more attractive because of a similarity in intelligence (a potential cue to kinship that has shown to influence ratings of likability or attractiveness; Byrne et al., 1968; Byrne, 1961; Byrne, Clore, & Smeaton, 1986; Byrne & Nelson, 1965).

5.1.3 Anchoring effect

The anchoring effect describes the tendency to make decisions that are biased toward the initial judgment (Tversky & Kahneman, 1974). Essentially, the anchoring effect suggests that individuals get stuck on initial attributions when no other information is available (i.e., when rating perceived intelligence from just a face). While some may reason that more intelligent people would be less susceptible to cognitive biases like anchoring effects, a thorough review by Stanovich and West (2008) found that various cognitive biases (including anchoring effects) are unrelated to cognitive ability. A targeted attempt to investigate individual differences influencing performance on anchoring tasks, namely personality and intelligence, also failed to replicate any benefits of cognitive ability on susceptibility to anchoring effects (Furnham, Boo, & McClelland, 2012).

Conversely, Kahneman and Frederick (2002) argued that while high intelligence respondents have the resources to assist in overcoming easy or typical mistaken intuitions, the authors also argue that when problems become more difficult, the ñcorrelation (between intelligence and cognitive bias) is likely to reverse because the more intelligent respondents are more likely to agree on a plausible error than to respond randomlyò (p.14). Thus, the improved ability to make logical connections and rationalize may actually prove counterproductive to overcoming cognitive biases. Taylor (1923) concurs generally that ñintelligence is not always a protection against rationalization. Indeed intelligence is what makes rationalization possibleò (p. 415). Thus, people who score higher on intelligence tests may be no less or even slightly more susceptible to cognitive biases such as the intelligence-attractiveness halo.

5.2 Research Questions

Various theories may account for a strong relationship between perceptions of intelligence and attractiveness. Further to this, the strength in the endorsement of the intelligence-attractiveness relationship may depend on individual differences that stem from a general self-similar bias (e.g., related to assortative mating, mate value, or kin selection). Based on literature suggesting cues to kinship can influence liking of others (Byrne et al., 1968; Byrne, 1961; Byrne, Clore, & Smeaton, 1986; Byrne & Nelson, 1965) and high intelligence does not limit susceptibility to anchoring bias (Stanovich & West, 2008) and may actually exacerbate it (Kahneman & Frederick, 2002), we predicted that individuals who score higher on intelligence tests would be more likely to rate faces they perceive as intelligent also as attractive.

To investigate the degree to which oneôs own intelligence influences the extent of a perceived intelligence-attractiveness bias, participants were asked to rate childrenôs faces for perceived intelligence and then attractiveness. Given the strength of the attractiveness haloôs influence on perceptions of intelligence when no other information is provided, it is likely participants are at least implicitly using cues related to attractiveness to make judgments of intelligence. Thus, we always obtained ratings of intelligence first and attractiveness second to measure the degree in which individuals find facial cues to intelligence related to attractiveness. After rating stimuli, participants completed a short intelligence test. Monin and Oppenheimer (2005) highlight the important distinction between the correlations of averaged ratings versus averaging individual correlations. Thus, a correlation between perceived attractiveness and perceived intelligence will be calculated for each participant resulting in individual pieces of data that can be compared to an individualȷs intelligence score. Each individualȷs ratings of intelligence were also compared to the average attractiveness to create two separate halo metrics: correlation between individual intelligence ratings and individual attractiveness ratings across all faces and correlation between individual intelligence ratings and averaged ratings of attractiveness within the sample.

5.3 Method

5.3.1 Facial stimuli

Stimuli consisted of 48[1] photographs of children aged 5 to 16, 24 of which were boys (*M* = 10.08, *SD* = 1.79) and 24 of which were girls (*M* = 9.87, *SD* = 3.10). Stimuli were obtained from the Dartmouth Database of Childrenȷs Faces (Dalrymple et al., 2013). All photographs were taken under standardized lighting conditions and camera set-up; individuals wore a black cap, did not wear make-up or jewelry, and posed with a neutral facial expression and head posture in front of a black background. Face images were aligned in size and position based on left and right pupils. Images were then resized and cropped (1608 x 2584 pixels) so that an equal proportion of head and neck was shown in each image.

[1] Forty-eight facial images were randomly selected from the original 90 facial images used in Chapter 4 (Study 2) to create a subset of stimuli for this experiment. Fewer stimuli were used to minimize participant fatigue, as participants were asked to rate both intelligence and attractiveness (rather than just one block of ratings as done in Chapter 4) and do a cognitive ability test.

5.4 Participants

After exclusions[2], a total of 126 participants (47 males, 79 females) aged 18 to 30 (M_{age} 21.12 years, *SD* = 2.46 years) were recruited to take part in a study entitled ñInfluences in the perception of intelligence in faces ï in lab study.ò Participants were recruited through the universityôs subject pool consisting of psychology students and community members. Participants were compensated for their time at a rate of £5/hour pro rata. Following similar methods as those used in Chapter 4, participants who reported their ethnicity as different from ówhite Caucasianô (21) were also excluded, as stimuli presented were Caucasian and judgments of other ethnicities may be more susceptible to stereotypes (Zebrowitz et al., 2007).

5.5 Procedure

5.5.1 Face-rating task

Participants first previewed all stimuli with each image displayed for one second. The stimuli were then re-presented so that participants could rate the perceived intelligence of each face on a 7-point Likert-type scale with endpoints *not at all intelligent* to *very intelligent*. The stimuli were then presented a third time to rate the attractiveness of each face on a similar 7-point scale with endpoints *not at all attractive* to *very attractive*. Participants had no indication that they would rate the same faces for attractiveness after ratings for intelligence. Since participants were briefed that they would make intelligence judgments, it was felt best to have them rate attractiveness only after completing all intelligence ratings. This minimized any priming effects which may have suggested that attractiveness and intelligence could be linked or that we were measuring the link between the two ratings. In both blocks, faces were presented in a random order. The minimum viewing time for each image was one second, but no maximum response time was enforced.

[2] The recruited sample was not restricted to university students, but the majority of participants were university students between the ages of 18 and 29. Four participants (two 34-year-olds, one 41 year-old, and one 56 year old) were excluded from the analysis as outliers in age. Re-running the analysis with these participants did not change the pattern of findings.

5.5.2 Intelligence measure

After rating the perceived intelligence and attractiveness of each image, participants took a short intelligence test drawn from the International Cognitive Ability Resources (ICAR) test (see Appendix 1), which has been shown to be moderately to strongly correlated with measures of cognitive ability and achievement (Condon & Revelle, 2014). The ICAR assessment is administered online and is an untimed assessment consisting of 16 items divided into four item types: verbal reasoning, letter and number series, matrix reasoning, and three-dimensional rotation. An average score was calculated for every participant based on the number of questions answered correctly, so that the score therefore represents the proportion of the test answered correctly (out of 1).

5.5.3 Statistical analysis

At the stimuli level, averaged ratings of attractiveness and intelligence were calculated for each face (48 total faces) based on the 126 raters. We compared averaged ratings of attractiveness and perceived intelligence, expecting a strong correlation based on the ñhalo effectò. Averaged ratings of attractiveness and perceived intelligence were also compared to the age and gender of the face.

Using similar methods as those used by Monin and Oppenheimer (2005), we computed correlations at the individual level. A correlation between participantsô ratings of intelligence and ratings of attractiveness for all 48 faces was calculated for each individual participant; the correlation value is hereafter named the ñindividual haloò. The stronger this correlation, the more an individualôs ratings for perceived intelligence resembled their ratings of perceived attractiveness for the facial stimuli presented (see Figure 5.1). While we expected a strong correlation between perceived attractiveness and perceived intelligence based on the halo effect, we investigated whether individualsô intelligence (measured by ICAR) could predict differences in the halo (i.e., the strength of the perceived intelligence and perceived attractiveness correlation across 48 faces).

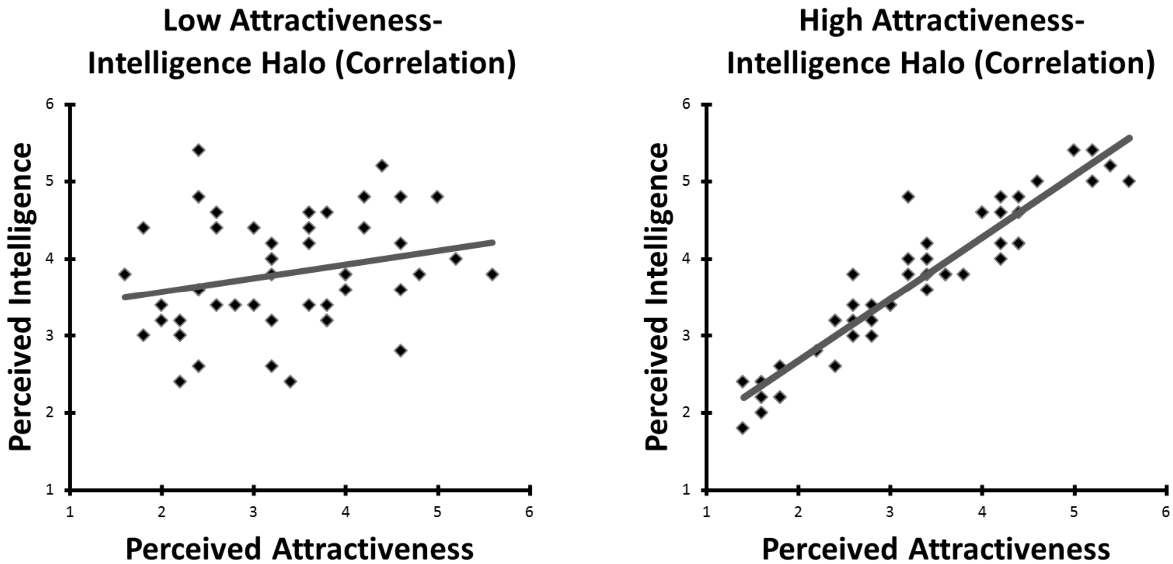


Figure 5.1. Variation in strength of the individual intelligence-attractiveness halo across individuals. Scatter plots visualizing the association of perceived intelligence and perceived attractiveness for an average of the 5 individuals with lowest attractiveness-intelligence halo (left, $r(48) = .25$) and highest (right, $r(48) = .94$) on the halo metric. Both perceived intelligence and attractiveness were rated on a 7 point Likert scale.

Given the need to get the same participant to rate perceived intelligence and attractiveness of the same stimuli, it was possible that one task would influence ratings on the next task. We believed having individuals rate intelligence first would mitigate this influence, yet we realize this does not eliminate potential bias. Thus, we calculated a separate ñhaloò metric between individual ratings of intelligence and the *average* attractiveness ratings (averaged across all 126 participants in the sample); the correlation value for this metric is hereafter named the ñaverage haloò[3].

A Kolmogorov-Smirnov test showed that measurements (ICAR) of intelligence ($p = .091$) and the perceived intelligence and attractiveness correlation ($p = .200$) across subjects were normally distributed. There were no problems with multicollinearity between

[3]A third halo metric was also calculated in which individual ratings of intelligence were compared to independent ratings of attractiveness (those collected in Chapter 4, Study 2) and can be referred to as 'independent halo'. There was no relationship between 'independent halo' and one's own intelligence (r(126 = .104, $p = .248$). The relationship between the 'independent halo' was strongly correlated ($r(126) = .98$, $p < .001$) with 'average halo'; given their near indistinguishable correlation, only one metric is discussed for simplicity.

these two variables (Variance Inflation Factor for all variables < 1.5). The ñaverage haloò metric (correlation between individual ratings of intelligence and *average* ratings of attractiveness) was not normally distributed (p = .028) so non-parametric statistics were used to analyze these data accordingly.

Additionally, the standard deviation (*SD*) and mean (*M*) rating of intelligence and attractiveness were calculated for each participant based on their ratings across the 48 faces. These measures of scale use provided a control for how they may influence the intelligence-attractiveness correlation halo. While the *M* and *SD* cannot influence the intra-individual correlation between attractiveness and intelligence, because Pearsonôs *r* correlation already controls for them, the differences in scale use between individuals could have an effect on group level analysis. For this reason, the *SD* and *M* ratings of attractiveness and intelligence were used in linear regression to ensure any effects observed would account for differences in scale use.

5.6 Results

As expected, a by-stimulus analysis found that averaged ratings of attractiveness and perceived intelligence were strongly correlated ($r(48) = 0.95$, $p < .001$). There was no significant correlations between gender of face (female coded as 0, male coded as 1) and perceived attractiveness ($r(48) = -0.24$, $p = .105$) or perceived intelligence ($r(48) = -0.21$, $p = .146$). Similarly, there was no significant correlation between age of the individual depicted in the facial stimuli and perceived attractiveness ($r(48) = -0.03$, $p = .854$), nor between age and perceived intelligence ($r(48) = 0.01$, $p = .962$).

5.6.1 Correlation matrix

At the individual level, the zero-order correlation matrix presented in Table 5.1 shows that there was a significant positive correlation between the intelligence-attractiveness rating correlation ñhaloò calculated for each participant and the participantsô IQ score ($r(126) = 0.21$, $p = .018$) (see Figure 5.2). Variables related to scale use (*SD* and *M* of perceived attractiveness and intelligence ratings) were not significantly correlated to participantsô intelligence-attractiveness halo. Participantsô intelligence-attractiveness halo was also not correlated with the participant age or gender. Participantsô mean attractiveness and intelligence ratings were strongly correlated ($p < 0.001$). This reflects participants varying in generosity with both judgments (i.e., if a participant generally gave high ratings of attractiveness across all stimuli, they did so similarly when rating intelligence). Similarly, the participantsô standard deviation of ratings for attractiveness and intelligence were strongly correlated ($p < .001$). This indicates the tendency to use the full scale range (i.e., 1-7) or to confine scores to a more restricted range (i.e., 2-4) in both judgments and that participant were using the scale similarly for both ratings of attractiveness and intelligence.

Table 5.1
Zero-order correlation matrix

	Halo	Age	Sex	IQ	*SD* Attract.	*M* Attract.	*SD* Intell.
Participant Age	.013	1					
Participant Sex	.033	.110	1				
Participant IQ Score	.210*	-.025	.121	1			
SD Attractiveness	.130	-.005	-.049	-.053	1		
M Attractiveness	.043	-.154	-.262**	.043	.120	1	
SD Intelligence	.111	.017	.089	-.033	.747***	-.059	1
M Intelligence	-.078^{A}	-.178*	-.165	-.006	.064	.625***	-.091

$^{***}p < .001$. $^{**}p < .01$. $^{*}p < .05$, $^{A}p < .1$. Two-tailed probabilities.

Note: Sex is coded female = 0, male = 1. Correlations are based on 126 participants. ñHaloò is the correlation for participantsô ratings of intelligence and attractiveness.

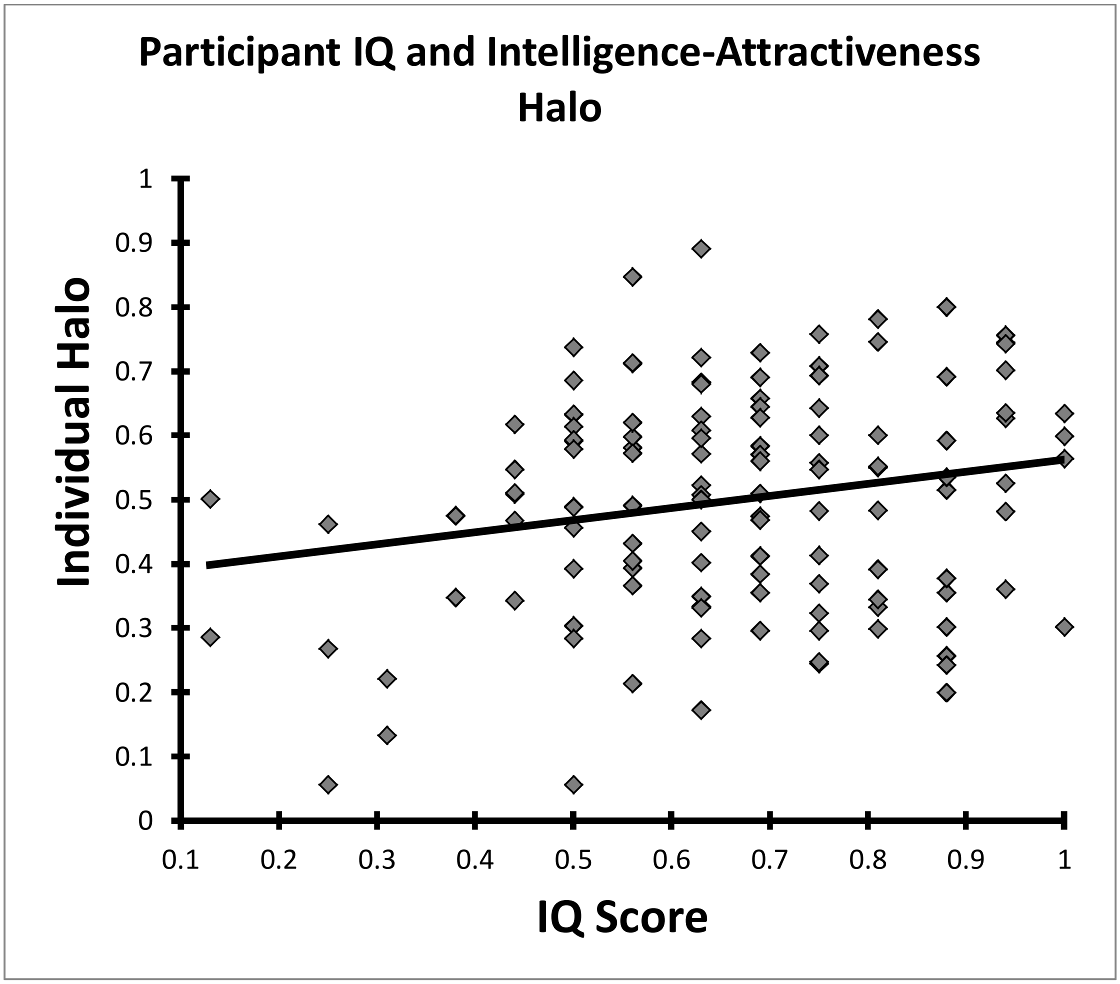


Figure 5.2. Participantsô actual intelligence and halo scatter plot. This scatter plot shows the positive correlation between participantsô actual intelligence (1 = every question answered correctly) and the strength of their intelligence-attractiveness halo (or correlation).

There was no significant correlation (Spearmanôs rho[4]) between the ñaverage haloò and individualôs own intelligence ($r_s = 0.06$, $p = 0.504$), *M* of intelligence ratings ($r_s = -0.08$, $p = 0.389$), or *SD* of intelligence ratings ($r_s = 0.11$, $p = 0.210$).

5.6.2 Regression

A multi-step hierarchical linear regression model was conducted to investigate whether participantsô IQ score would predict the strength of their intelligence-attractiveness halo (Table 5.2) with and without control for scale use variables in the model. In step 1 of the model, the participantôs IQ score was entered as a predictor of the intelligence-attractiveness halo. In step 2 of the model, scale use variables (*SD* and *M* of attractiveness and intelligence ratings) were entered to account for any differences in scale use. Both models 1 and 2 indicated that participantsô IQ score significantly predicted ($p = .018$) participantsô intelligence-attractiveness halo (see Table 5.2).

Table 5.2
Hierarchal linear regression

Steps	Variable	*B*	*SE*	β	*CI* Lower Bound	*CI* Upper Bound	R^2	*F*	ΔR^2
1	IQ Score	.200*	.083	.210	.035	.365	.04	5.74	.044*
2	IQ Score	.201*	.084	.212	.036	.366	.08	2.09	.036
	SD Attractiveness	.068	.076	.123	-.082	.218			
	M Attractiveness	.039	.037	.119	-.035	.112			
	SD Intelligence	.011	.084	.018	-.155	.178			
	M Intelligence	-.066	.047	-.158	-.159	.027			

***$p < .001$. **$p < .01$. *$p < .05$. Two-tailed probabilities.
Note: Dependent variable is the attractiveness-intelligence halo (correlation) calculated for each participant.

[4] A standard Pearson's r correlation was also analysed for the 'average halo' metric, even though it was not normally distributed. The pattern of findings did not change; that is, no significant correlations or non-significant trends were observed between any of the variables mentioned.

5.7 Discussion

As predicted, perceived intelligence and perceived attractiveness of facial stimuli were strongly correlated. In a more significant contribution to the literature, our findings suggest that participants varied in the degree of endorsement of the perceived intelligence-attractiveness relationship. Specifically, participants who scored higher on intelligence tests were more likely to endorse the perceived intelligence-attractiveness relationship. No significant interaction between individual intelligence and scale use (*SD* and *M* ratings for perceived intelligence and attractiveness) was found, and the relationship between participantsô intelligence score and their perceived intelligence-attractiveness halo remained significant after controlling for differences in participant scale use. We found no relationship between gender or age of participant and the intelligence-attractiveness halo.

We also found that there was no significant relationship between own intelligence and the ñaverage haloò. The difference between the ñindividual haloò and ñaverage haloò is salient; the ñindividual haloò is calculated by correlating individual ratings of intelligence and individual ratings of attractiveness, whereas the ñaverage haloò correlation is calculated based on a correlation between an individualôs ratings of intelligence and the average attractiveness (of all 126 participants in the sample) of stimuli. Indeed, literature has suggested that individual face preferences are unique to each individual and are primarily related to individual differences in learning what is attractive from their environment (Germine et al., 2015), but may also be related to differences in culture (Penton-Voak et al., 2004), self-similarity resemblance (Alvergne, Faurie, & Raymond, 2009; Debruine, 2002), or self-evaluation (Kandrik & DeBruine, 2012; Little et al., 2001). Thus, measuring how similar an individualôs intelligence ratings are to average attractiveness ratings is more of a measure of conformity to what is considered by most as attractive, rather than a measure of how similar each personôs perceptions of intelligence and attractiveness are. Alternatively, one could interpret the positive relationship between intelligence and the ñindividual haloò and null relationship with the ñaverage haloò to suggest that intelligent people are more likely to use heuristics like the anchoring effect. If so, one would expect intelligent individuals to be more likely to give similar ratings for other pairs of attributes.

Our findings concur with prior research showing that ratings of childrenôs intelligence from facial images correlate strongly with their rated attractiveness (Asch, 1946; Dion et al., 1972; Langlois et al., 2000). This is a troubling finding given the potential implications in education, as research suggests expectations of childrenôs intelligence can influence their academic performance up to five years after measurement of classroom teachersô expectations (de Boer et al., 2010). Expectancy effects can be particularly robust in groups of students who are considered to be at risk of poor academic attainment (Hinnant, OôBrien, & Ghazarian, 2009; Sorhagen, 2013). Hence, our findings that individuals with higher intelligence have a stronger endorsement of the intelligence-attractiveness halo may be particularly worrying if we assume that individuals in university education and with varying levels of cognitive performance (such as those studied here) will progress to various employments including teaching.

Our findings highlight one particular individual difference that is related to the endorsement of the intelligence-attractiveness relationship. It is possible that people who score higher on intelligence tests are either more susceptible to a halo effect (perhaps due to the anchoring effect) or find faces they believe to be intelligent more attractive (perhaps due to a bias for self-similarity). We suggest that future experimental designs should use more controlled and concentrated experiments to examine these and other possible explanations. For instance, the intelligence test used in this study (ICAR) was very short; a more comprehensive intelligence assessment may shed light on which cognitive abilities are most strongly related to the perceived intelligence-attractiveness halo, thus narrowing potential explanations. Future research could also benefit from comparing participantsô intelligence-attractiveness halo to participantsô use of anchoring (see Tversky & Kahneman, 1974 for a classic study on measuring anchoring), heuristics, and stereotypes. Conversely, research could investigate whether people who are rated by others as more attractive are more likely to endorse the perceived intelligence-attractiveness correlation (halo).

Regardless of rationale (kin selection or anchoring effect) or directionality (i.e., whether perceived intelligence influences perceptions of attractiveness or vice versa), our findings reveal that individuals differ in their vulnerability to this bias. Further studies on other individual differences potentially related to the endorsement of the perceived intelligence-attractiveness halo are necessary, especially in the context of expectations of children who are arguably most vulnerable to perceptions of intelligence, given the consequences of expectancy effects discussed. Davis (1951) said ñthe eye sees only what the mind is prepared to comprehendò; thus, we should strive to better understand the root of biases in an effort to see past them.

Chapter 6: Blinded by Beauty: Attractiveness Bias and Accurate Perceptions of Academic Performance

This chapter is based on research that is under peer-review in an academic journal:

Talamas, S.N., Mavor, K. I., & Perett, D. I. (in revision). Blinded by beauty: Attractiveness bias and accurate perceptions of academic performance.

6. Abstract

Despite the old adage to not ñjudge a book by its coverò, facial cues often guide first impressions and these first impressions guide our decisions. Literature suggests there are valid facial cues that assist us in assessing someoneôs health or intelligence, but such cues are overshadowed by an ñattractiveness haloò whereby desirable attributions are preferentially ascribed to attractive people. The impact of the attractiveness halo effect on perceptions of academic performance in the classroom is concerning as this has shown to influence studentsô future performance. We investigated the limiting effects of the attractiveness halo on perceptions of actual academic performance in the faces of 100 university students. Given the ambiguity and various perspectives on the definition of intelligence and the growing consensus on the importance of conscientiousness over intelligence in predicting actual academic performance, we also investigated whether perceived conscientiousness was a more accurate predictor of academic performance than perceived intelligence. Perceived conscientiousness was found to be a better predictor of actual academic performance when compared to perceived intelligence and perceived academic performance, and accuracy was improved when controlling for the influence of attractiveness on judgments. These findings emphasize the misleading effect of attractiveness on the accuracy of first impressions of competence, which can have serious consequences in areas such as education and hiring. The findings also have implications for future research investigating impression accuracy based on facial stimuli.

6.1 Introduction

A review by Langlois et al. (2000) suggested that people regularly make judgments based on appearance and argued that ñif humans were not biased to judge others on their appearance, they would not need to remind their children not to judge books by their coversò (p. 408). While frequently warned against ñjudging a book by its coverò, the field of face perception is filled with evidence that suggests that the face contains a substantial amount of information for evaluators to infer traits. For instance, Kramer and Ward (2010) found that four of the Big Five personality traits, as well as physical health, were perceived with some limited accuracy from internal facial features alone and three of the Big Five traits were accurately perceived (just above chance) from just one side of the face. Similarly, Penton-Voak, Pound, Little, and Perrett (2006) found that there was some limited accuracy in perceptions of extraversion, emotional stability, and openness to experience when presented with images of composite faces (combining the faces of people with the same personality). Also, research by Little, Burt, Penton-Voak and Perrett (2001) found that evaluators were differentially attracted to faces depending on personality traits desired in a partner; that is, ñif a trait is desired then faces perceived to possess that trait are found more attractive than faces which do not possess that traitò (p. 1107). Such research highlights potential accuracy in face perception and the relationship between perceived personality traits and attractiveness.

Indeed, when investigating the accuracy of perceived intelligence (Kleisner et al., 2014) and of perceived health (Kalick, Zebrowitz, Langlois, & Johnson, 1998) in faces, it was found that accuracy was improved to a level above chance when controlling for attractiveness bias. The ñattractiveness halo effectò in which desired personality traits are ascribed to attractive people over unattractive people (Dion et al., 1972) seems to influence the use of attractiveness as a cue when attempting to accurately perceive health or intelligence in faces and is in turn, limiting peopleôs accuracy. The relationship seems to reflect a *suppression effect*, in which the suppressor (perceived attractiveness) is correlated with the other predictor variable (perceived health or intelligence), but is not related to the dependent variable (actual health or intelligence), so when this noise (relationship between attractiveness and perceived health or intelligence) is controlled for, the accuracy in perceptions of actual health or intelligence is increased (Conger, 1974; Maassen & Bakker, 2001; MacKinnon, Krull, & Lockwood, 2000; Mavor, Macleod, Boal, & Louis, 2009; Tzelgov & Henik, 1991).

6.1.1 Actual intelligence and attractiveness

Kleisner, Chvatalova, and Flegr (2014) reported accurate perceptions of intelligence in menôs but not womenôs faces. It is important to note that a significant relationship between perceived and actual intelligence was only evident after statistically controlling for perceived attractiveness, though perceived attractiveness itself was not found to be a valid cue to actual intelligence. Kleisner et al. (2014) argue that one of the reasons accurate estimations of intelligence are demonstrated in men but not women may be due to the stronger effect of the attractiveness halo in perceptions of female intelligence. These findings highlight the pervasive and detrimental influence of attractiveness on accuracy in attributions.

For decades, researchers have debated the accuracy in perceived intelligence and whether attractiveness is a valid cue to actual intelligence (Denny, 2008; Jackson, Hunter, & Hodge, 1995; Kanazawa, 2011; Kleisner et al., 2014; Langlois et al., 2000). A study by Zebrowitz, Hall, Murphy, and Rhodes (2002) found that judgments of intelligence from faces were more accurate than chance for images from childhood, puberty, and middle adulthood, but not more accurate than chance in adolescence or late adulthood. Zebrowitz et al. (Zebrowitz et al., 2002) discussed how facial attractiveness might relate to actual intelligence based on various potential paths: (a) biological, with good genes being inherited; (b) environmental, including the impact of nutrition and healthcare; (c) influence of intelligence on grooming and health decisions; (d) and a self-fulfilling prophecy, in which attractive people are expected to be smarter and given greater opportunities to become smarter. A later study by Zebrowitz and Rhodes (2004) investigated the relationship between facial attractiveness and actual intelligence in the upper and lower halves of the attractiveness distribution and reported that, consistent with the ñbad genes hypothesisò, facial attractiveness was a valid cue to actual intelligence only in the lower half of the attractiveness distribution. As discussed in Chapter 3, consistent with the ñanomalous face overgeneralization hypothesisò, attractiveness was used to guide impressions of intelligence across the entire attractiveness distribution (Zebrowitz & Rhodes, 2004). Thus, participants were accurate in judging intelligence based on attractiveness, but only because faces perceived as unattractive were judged as having low intelligence. These findings are consistent with the ñbad genesò hypothesis, which implies that faces perceived as very unusual or unattractive may be an indicator of poor genetic fitness.

A more recent study by Mitchem et al. (2014) highlights several problems in previous research investigating attractiveness and intelligence, namely publication bias (systematic publishing of results different from unpublished studies), inconsistencies in definitions of intelligence and attractiveness, research design flaws, and small sample sizes. They conducted research on the largest sample to date, utilizing a twin dataset and independently collected measures of facial attractiveness and general intelligence. They found no support for a relationship between actual intelligence and perceived facial attractiveness.

6.1.2 Attractiveness and academic performance

Research has also investigated the potential relationship between perceived attractiveness and *actual* academic performance, with no clear consensus. Some investigations have showed that students who are perceived as more attractive achieve higher grades and higher scores on standardized achievements tests (Felson, 1980; Salvia et al., 1977; Singer, 1964). Other studies failed to find any relationship (Clifford, 1975; Sparacino & Hansell, 1979).

Nonetheless, the relationship between perceived attractiveness and *perceptions* of academic performance is clear. A meta-analysis conducted by Dusek and Joseph (1983) scrutinized 14 studies investigating physical attractiveness and its relation to teacher expectancy. The review concluded that perceived facial attractiveness is significantly correlated with teacher expectations of academic performance and positive personality attributes. For example, a cornerstone study by Clifford and Walster (1973) indicated a significant correlation between physical appearance and teacher expectations. A similar study also suggested a positive correlation between teachersô ratings of attractiveness and expectations of childrenôs skills (Kenealy, Frude, & Shaw, 2001), showing that teachers judged children rated as more attractive as more social, confident, popular, academically strong, and more likely to become leaders than students who were rated as less attractive.

Another meta-analytic review by Ritts, Patterson, and Tubbs (1992) found that students perceived as attractive are more likely than students perceived as unattractive to be ascribed positive educational traits. Specifically, students perceived as attractive were judged as more intelligent, having more academic potential, and having better grades. It was also noted that other variables such as gender, race, and knowledge of past performance also influenced expectations, but were not significant moderators to the attractiveness influence (Ritts et al., 1992). Consequently, while there is little consensus and weak supporting evidence for a relationship between perceived attractiveness and *actual* intelligence or academic performance, there is convincing research documenting the relationship between perceived attractiveness and *perceived* intelligence and academic performance.

6.1.3 Accuracy in face perception

Research suggests extroversion can be accurately perceived after only a 50 millisecond exposure to a face (Borkenau, Brecke, Möttig, & Paelecke, 2009), strength can be accurately estimated from faces independent of height, weight, and age (Sell et al., 2009), and the dark triad of personality (Machiavellianism, narcissism, and psychopathy) can be accurately perceived in composites of expression-neutral facial images (Holtzman, 2011). Note here that accuracy does not imply a large effect size; accuracy may be significant, but with performance only slightly above chance. Nonetheless, this limited accuracy is still somewhat impressive given the lack of conventional information (i.e., information about behavior) that we typically think affects such judgments; thus, the effects may be small, but they are still noteworthy. Todorov, Olivola, Dotsch, and Mende-Siedlecki (2015) suggests that little time is needed to arrive at a consensus on social attributions from faces, yet many studies overstate the validity of these attributions. There are various perspectives on why and how such social attributions from faces are made that explain the potential both for accuracy and for limitations in accuracy (see Chapter 1).

Biological cues may shed light on how people are rating social judgments at above-chance accuracy from neutral-expression facial images alone. For instance, research suggests the shape of a face (sexual dimorphisim, discussed in Chapter 1) is related to the current (Lefevre et al., 2013; Penton-Voak & Chen, 2004; Pound, Penton-Voak, & Surridge, 2009) and prenatal (Fink et al., 2005) levels of testosterone. Research has also suggested that adiposity is closely associated with circulating testosterone (Rantala et al., 2013) and that adiposity has been shown to be related to perceived health and attractiveness, as well as measures of actual cardiovascular health and proneness to respiratory illness (Coetzee et al., 2009). Further, facial symmetry, and sex typicality in face shape have been shown to be related to disease resistance (Thornhill & Gangestad, 2006). Similarly, an average face shape may signal health, as abnormalities that make a face look slightly different from the average may be caused by genetic or environmental stress (Zebrowitz & Rhodes, 2004, p. 169). Carotenoid coloration in the face has also been found to signify quality of current diet (Stephen, Law Smith, et al., 2009). The face can also provide clues to recent sleep history, with those who are sleep deprived having less eyelid-openness and more downward mouth curvature than those that are well rested (see Chapter 4; Sundelin et al., 2013).

6.1.4 Health, attractiveness and over-generalization

Clearly, the face provides a variety of cues to hormones, health, and sleep status. One thing all of these cues have in common is their relationship to attractiveness. Namely, research investigating attractiveness and the ñgood genesò theory has argued that facial symmetry (Perrett et al., 1999), averageness (Langlois & Roggman, 1990), sexual typicality (Perrett et al., 1998), eyelid-openness and mouth-curvature (Axelsson et al., 2010), carotenoid coloration in the face (Stephen, Law Smith, et al., 2009), and adiposity (Coetzee et al., 2009) may be attractive because of their relationship to health (see Chapter 1; Barber, Arnott, Braithwaite, Andrew, & Huntingford, 2001; Gehrman et al., 2011; Rhodes, 2006).

The link between potential cues to health in the face and perceived attractiveness is one explanation for the ñattractiveness halo effectò. Research suggests this preference for attractive (or healthy looking) individuals appears early in infancy, with infants as young as two-months old gazing longer at attractive faces over unattractive or unusual looking faces (Slater et al., 1998, 2000). It is unknown whether or not such preferential looking reflects early learning (Bushnell, 2001; De Haan, Johnson, Maurer, & Perrett, 2001; Pascalis, de Schonen, Morton, Deruelle, & Fabre-Grenet, 1995). Further, Langlois, Roggman, and Reiser-Danner (1990) found that 12-month-old infants would play longer, have more involvement, experience less distress and withdrawal, and seem to exhibit more pleasure when interacting with attractive people as compared to unattractive people. Also noteworthy is the degree of agreement regarding facial attractiveness. Specifically, studies have shown consistency between men and women regarding opinions of facial attractiveness (Rhodes, 2006). Surprisingly, agreement on facial attractiveness is apparent even across different countries (Langlois et al., 2000; Tovée et al., 2006).

In an attempt to investigate whether facial attractiveness provides evidence of actual health, which may partially explain this positive bias toward attractive people, Kalick, Zebrowitz, Langlois and Johnson (1998) found that evaluatorsô perceptions of attractiveness are actually poor predictors of current or future actual health. While attractive faces were mistakenly rated as healthier than their peers, the correlation between perceived health and actual health increased when attractiveness was statically controlled, implying that attractiveness suppresses the accurate recognition of health.

This improvement in accuracy of health judgments after controlling for attractiveness is similar to the improved accuracy of intelligence judgments when the attractiveness halo is statistically controlled (Kleisner et al., 2014). Indeed there is evidence to suggest a relationship between various health factors and cognitive or intellectual performance. Specifically, it has been found that phobic anxiety (Okereke & Grodstein, 2013), trait anxiety (Bishop, 2009; Eysenck et al., 2007), drug use (Sim, Simon, Domier, Richardson, & Rawson, 2001), diabetes (Gregg, 2000; Munshi et al., 2006), poor sleep (Ohayon & Vecchierini, 2005), and frailty (Yassuda et al., 2012) have been negatively associated with both health and cognitive function in older individuals. Similarly, exposure to chronic aircraft noise (Haines, Stansfeld, Job, Berglund, & Head, 2001), infection with parasitic worms (Jardim-Botelho et al., 2008) and food insufficiency (Alaimo, Olson, & Frongillo Jr, 2001) have been found to negatively impact health and cognitive performance in children. Given the close relationship between actual health, actual cognitive performance, and perceived attractiveness, facial cues to health might also be cues to both attractiveness and cognitive ability (see general ñfitness factorò discussed in Chapter 1 and 3), leading to correlations between attractiveness and perceived competence. Such correlation might lead to overgeneralization and inaccurate perceptions of academic ability in healthy individuals based spuriously on attractiveness. Hence we explore whether or not the ñblinded by beautyò phenomenon found in perceptions of health

(Kalick et al., 1998) and intelligence (Kleisner et al., 2014) also applies to the perception of academic performance from first impressions of neutral-expression static facial images.

6.1.5 Theories of intelligence and academic performance

Given the controversy over definitions of intelligence and differences in theories of intelligence (Neisser et al., 1996) it is likely that, in addition to being limited by the attractiveness halo, accurate perceptions of intelligence are also limited by variation in understanding on the meaning of the term ñintelligenceò. While someone who agrees with a fixed theory of intelligence believes there is little a person can do to change their actual intelligence, someone with a growth theory of intelligence argues that intelligence can change over time with the appropriate environment (Blackwell et al., 2007; Dweck et al., 1995; Hong, Chiu, Dweck, Lin, & Wan, 1999).

Perceptions of academic performance from faces are likely to suffer similar inconsistences in evaluator perspectives of what factors most influence academic performance. While research has consistently shown that intelligence predicts academic performance (Chamorro-Premuzic, 2007), it is well documented that the personality trait of conscientiousness is a stronger predictor of academic performance than intelligence (Chamorro-Premuzic & Furnham, 2004; Chamorro-Premuzic, 2007). Hence, it could be argued that asking evaluators to assess academic performance from faces would yield just as much ambiguity as attributions of intelligence, as consensus would be adversely affected both by disagreement in fixed vs. growth theories of intelligence, and by different perspectives on how much academic performance relies on intelligence versus conscientiousness (see Chapter 2).

Research on the Intelligence Competence Theory (ICT) further undermines consensus of perceived academic performance by suggesting that people who are less intelligent compensate by becoming more conscientious to reach their goals (Moutafi, Furnham, & Crump, 2003; Moutafi et al., 2004). Thus, some might think a person with a less intelligent looking face is more academically able because the person may work harder to get better grades. Previous studies have highlighted consensus and accuracy of perceptions of most of the Big Five personality traits from faces, yet conscientiousness is sometimes (Little & Perrett, 2007), but not always correctly detected (Kramer & Ward, 2011; Penton-Voak et al., 2006). Given the relationship between actual conscientiousness and academic performance (compared to intelligence), we explore whether perceptions of conscientiousness are more likely to predict actual academic performance than perceptions of intelligence.

6.2 Research Questions

Research investigating perceptions of academic performance has primarily been concerned with exploring the potential of attractiveness to be a valid predictor of academic performance (Clifford, 1975; Felson, 1980; Murphy, Nelson, & Cheap, 1981; Salvia et al., 1977; Singer, 1964; Sparacino & Hansell, 1979) and exploring the effects of perceived academic performance on studentsô actual performance in the future (Clifford & Walster, 1973; Dusek & Joseph, 1983; Kenealy et al., 2001; Ritts et al., 1992). No research that we are aware of has investigated the potential accuracy of perceptions of actual academic performance from faces when controlling for the attractiveness halo. Given the different perspectives and theories of the term ñintelligenceò (Dweck et al., 1995; Dweck & Henderson, 1989; Neisser et al., 1996) and the varying perspectives on how much intelligence predicts academic performance compared to conscientiousness (Moutafi et al., 2003, 2004), we hypothesize that evaluators will be more accurate in perceiving actual academic performance when specifically asked to rate conscientiousness than when asked to rate the more ambiguous terms ñintelligenceò or ñacademic performanceò.

Further, it is possible that attractiveness detracts from accuracy in perceptions of academic performance, much as attractiveness can detract from accuracy in perceptions of health and intelligence. While there are various seemingly logical explanations for why attractiveness could be a valid cue to academic performance, the empirical evidence for a link between the two is extremely weak and perhaps only existing in the lower half of the distribution (i.e., driven by potential outliers with genetic or developmental problems affecting both appearance and cognitive ability). We hypothesize an ñattractiveness haloò in which attractiveness is not linked to *actual* academic performance but is significantly correlated with *perceptions* of academic performance. Further, we hypothesize that controlling for the misperceptions about attractiveness may improve accuracy in perceptions of academic performance.

We argue that this effect of controlling for attractiveness takes the form of a classic type of suppression (see Conger, 1974; Maassen & Bakker, 2001; MacKinnon et al., 2000; Mavor et al., 2009; Tzelgov & Henik, 1991). In classical suppression, the suppressor is unrelated to the variable of interest but is related to the predictor, and therefore the shared variance between the predictor (in this case, *perceived* conscientiousness, intelligence or academic performance) and the suppressor (attractiveness) is unrelated to the outcome measure (*actual* academic performance). By controlling for this irrelevant variance in the predictor, the strength of the association between the predictor and outcome variable increases. In other words, controlling for attractiveness may reveal a ñblinded by beautyò phenomenon similar to that found in health (Kalick et al., 1998) and intelligence (Kleisner et al., 2014) judgments.

6.3 Method

6.3.1 Facial stimuli

Students from the University of St Andrews were recruited to take part in an experiment called ñInfluences in the Perception of Intelligence in Facesò as part of a larger data collection. One hundred of the most standardized (e.g., clean shaven, neutral expression and head posture) Caucasian faces between the ages of 18 and 24 (M_{age} = 20.85, *SD* = 2.15; 67 females, 33 males) were chosen as stimuli. The original image collection contained more women than men and removal of males with beards enhanced the gender bias. Nonetheless, we maximized the number of stimuli available for judgments to maintain power in the analysis. Selection of standardized faces was done blind to their academic performance. Todorov and Porter (2014) highlight significant differences in person impressions within multiple facial photos of the same person due to random variation and discusses how this can influence accuracy of personality inferences based on faces. Thus, it was important to select the most standardized stimuli. All of the stimuli photographs of participants used were taken under standardized lighting conditions and camera set-up; individuals had their hair pulled back, did not wear any kind of make-up or jewelry, and were instructed to pose with a neutral facial expression[1]. Face images were aligned on left and right pupils. Images were then resized and cropped (1608 x 2584 pixels) so that an equal proportion of hair and neck was exposed in each.

6.3.2 Academic performance measures

All participants consented to releasing their academic performance records for the purpose of this research. Academic records were accessed via the Universityôs database. Academic performance at the University of St Andrews is marked on a 20-point scale reported to one decimal place for final module grades. An average academic performance was calculated by taking the Grade Point Average (GPA) across every year weighted by every module credit completed by the student. Participants varied in their course of study and the number of modules completed based on their year and semester of study (63 in Sciences, 37 in Arts; 44 first- and second-year undergraduates, 39 third- and fourth-year undergraduates, and 17 in postgraduate courses). Accordingly, methods of evaluation (e.g., exam, essay, and dissertation) varied.

[1] Due to the findings in Chapter 4, which suggest subtle differences in "neutral" mouth curvature can influence perceptions of intelligence, we checked for any outliers in our stimuli with regards to mouth curvature. No outliers were found.

6.4 Participants

6.4.1 Face raters

Four separate groups of participants were recruited and paid via Amazon Mechanical Turk to obtain ratings of perceived attractiveness, intelligence, conscientiousness, and academic performance (no other face ratings were obtained for this study). Table 6.1 shows the demographics of each participant group. Differences in sample sizes were based on differences in the number of participants completing the task while the link was live on Amazon Mechanical Turk and the number of exclusions. Consistent with methods in previous chapters, participants who reported their ethnicity as different from ñwhite Caucasianò were excluded when calculating the average ratings of perceived attractiveness, intelligence, conscientiousness, and academic performance, as stimuli presented were Caucasian and judgments of other ethnicities may be more susceptible to stereotypes (Zebrowitz et al., 2007). Analysis was re-run with all participants and there were no differences in the pattern of findings; that is, all significant results remain significant, and all non-significant results remain non-significant.

Table 6.1
Sample information

Participant Group	*M* Age	*SD* Age	Exclusions	Total Sample	Gender
Attractiveness	40.16	12.44	5	32	F = 11 M = 21
Intelligence	40.00	8.99	12	25	F = 16 M = 9
Conscientiousness	42.32	12.17	8	20	F = 10 M = 10
Academic Performance	38.28	12.29	16	47	F = 22 M = 25

Note: Each participant group reflects a separate group of raters for one perception task. Female is represented by F and male by M.

6.5 Procedures

6.5.1 Face rating task

Evaluators first previewed all stimuli with each image displayed for one second. The stimuli were then re-presented so that participants could rate the face on the focal trait for each sample: perceived attractiveness, intelligence, conscientiousness, or academic performance. Faces were presented in random order. To ensure the paid participants were not quickly and hastily clicking through images, images were presented for at least one second before participants were allowed to continue to the next image, but no maximum response time was enforced. Evaluators then completed a questionnaire inquiring about their age, gender, and ethnicity.

Facial ratings were done on a 7-point scale with endpoints according to the face rating task: attractiveness endpoints were *not at all attractive* to *very attractive*; perceived intelligence endpoints were *not at all intelligent* to *very intelligent*; perceived conscientiousness endpoints were *not at all conscientious* to *very conscientious*; and perceived academic performance endpoints were *very low academic performance* to *very high academic performance*.

Participants who rated perceived academic performance were presented with a statement at the top of each facial image presented asking, ñPlease rate how well you think this person does in University compared to the other people presented.ò Participants who rated perceived conscientiousness were presented with a statement at the top of each facial image presented that read ñConscientiousness is the personality trait of being thorough, careful, or vigilant ï with the desire to do a task well. Based on the definition of conscientiousness provided ï how conscientious do you perceive this face to be compared to the other faces presented?ò

6.6 Results

6.6.1 Facial averages

Consistent with methods used in Chapter 4, facial averages of the faces presented were created to help the reader visualize perceptions of conscientiousness and the attractiveness halo. Facial averages (see Figure 6.1) were synthesized from the top 25% male and female faces (8 male and 16 female faces) and bottom 25% male and female faces with the highest and lowest scores on perceived conscientiousness (Benson & Perrett, 1992, 1993). These average images were then made symmetrical (see Perrett et al., 1999).

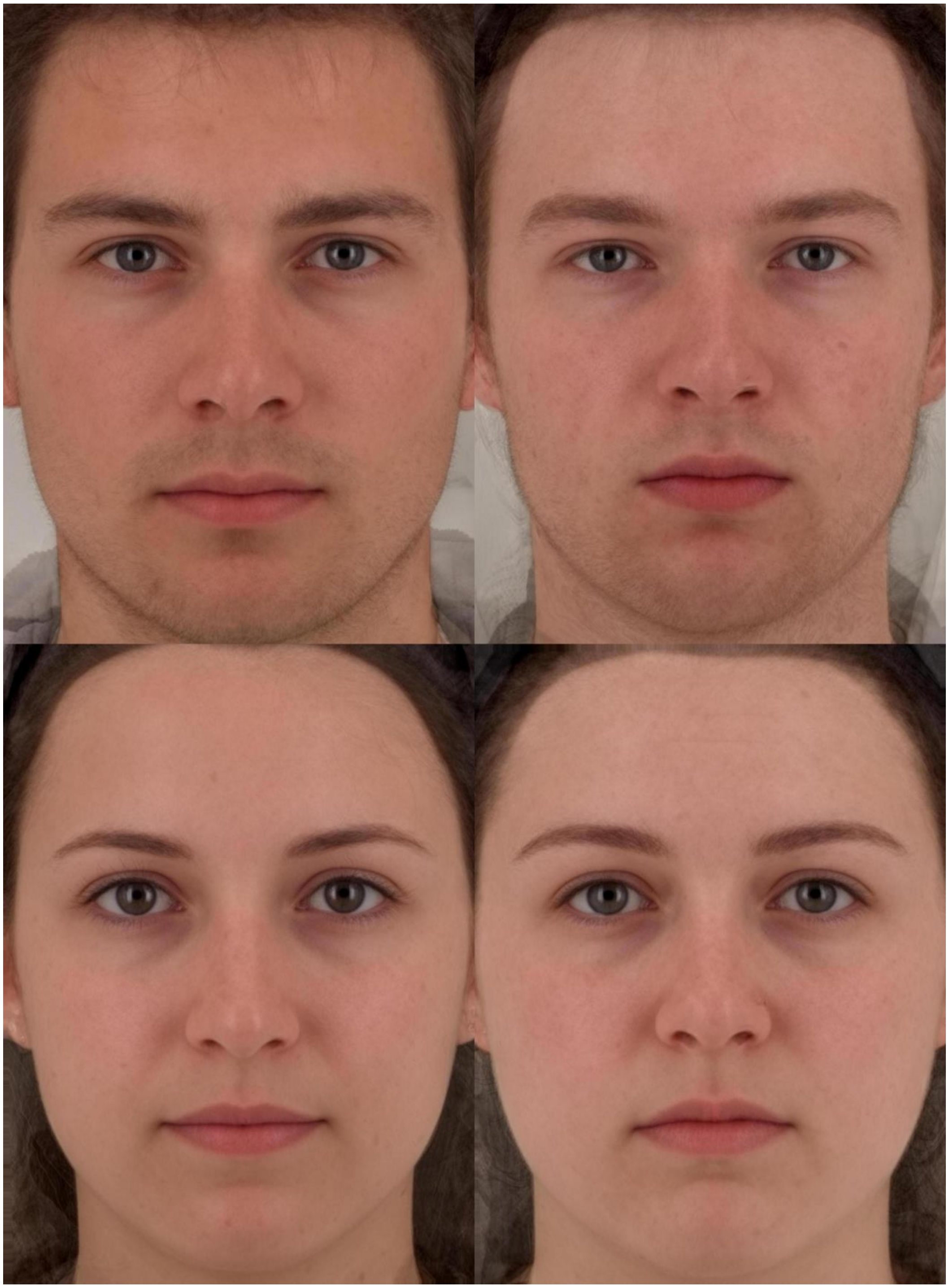


Figure 6.1. The images presented reflect the top and bottom 25% of faces percieved as most (left) and least (right) conscientious. The attractiveness halo would suggest that faces percieved as most conscientious (left) would be more attractive than the faces rated as least conscientious (right).

6.6.2 Correlation matrix

An average score of perceived attractiveness, intelligence, academic performance and conscientiousness was calculated for each of the 100 faces based on the average of all the evaluator ratings. Table 6.2 gives the zero-order correlations between ratings and actual academic performance and the demographic variables of age and gender. There was a significant correlation between older age and higher actual academic performance and female faces were perceived as more attractive (see Table 6.2). As predicted, there was no relationship between attractiveness and actual academic performance (r = 0.03), but a strong positive correlation between attractiveness and perceived intelligence (r = 0.81), attractiveness and perceived academic performance (r = 0.74), and attractiveness and perceived conscientiousness (r = 0.81).

Table 6.2
Zero-order matrix

	Actual Academic Performance	1	2	3	4	5
1. Age	.282**	**1**				
2. Sex	-.098	-.011	**1**			
3. Attractiveness	.027	.296**	-.296**	**1**		
4. Intelligence	.072	.302**	-.206*	.807***	**1**	
5. Conscientiousness	.175^{A}	.313**	-.360***	.812***	.825***	**1**
6. Academic Performance	.124	.308**	-.150	.738***	.802***	.810***

$^{***}p < .001$. $^{**}p < .01$. $^{*}p < .05$, $^{A}p < .1$. Two-tailed probabilities.
Note: Sex is coded female = 0, male = 1. Correlations are based on 100 faces.

Given the high correlations between rated attributes (perceived attractiveness, perceived conscientiousness, perceived intelligence and perceived academic performance), we wanted to ensure that any statistical controls were based on sufficiently reliable measures and discriminability valid constructs (consistent with methods used in Chapter 4). Cronbachôs alphas were calculated for perceived attractiveness (32 ratings; α = 0.94), intelligence (25 ratings; α = 0.86), academic performance (20 ratings; α = 0.73), and conscientiousness (47 ratings; α = 0.91). After correcting for attenuation due to measurement error (Nunnally, 1978; Osborne, 2003), the relationships between attractiveness and perceived intelligence (r = 0.90), between attractiveness and perceived academic performance (r = 0.89), and between attractiveness and perceived conscientiousness (r = 0.88) were all marginally higher but do not indicate redundancy.

Partial correlations were conducted in which the influence of age of face, sex of face, and perceived attractiveness were controlled for[2]. Partial correlations revealed (see Figure 6.2) a significant correlation between perceived conscientiousness and actual academic performance (r = 0.22, p = 0.035). The partial correlations reveal no relationship between actual academic performance and perceived academic performance (r = 0.13, p = 0.191) or perceived intelligence (r = 0.06, p = 0.544).

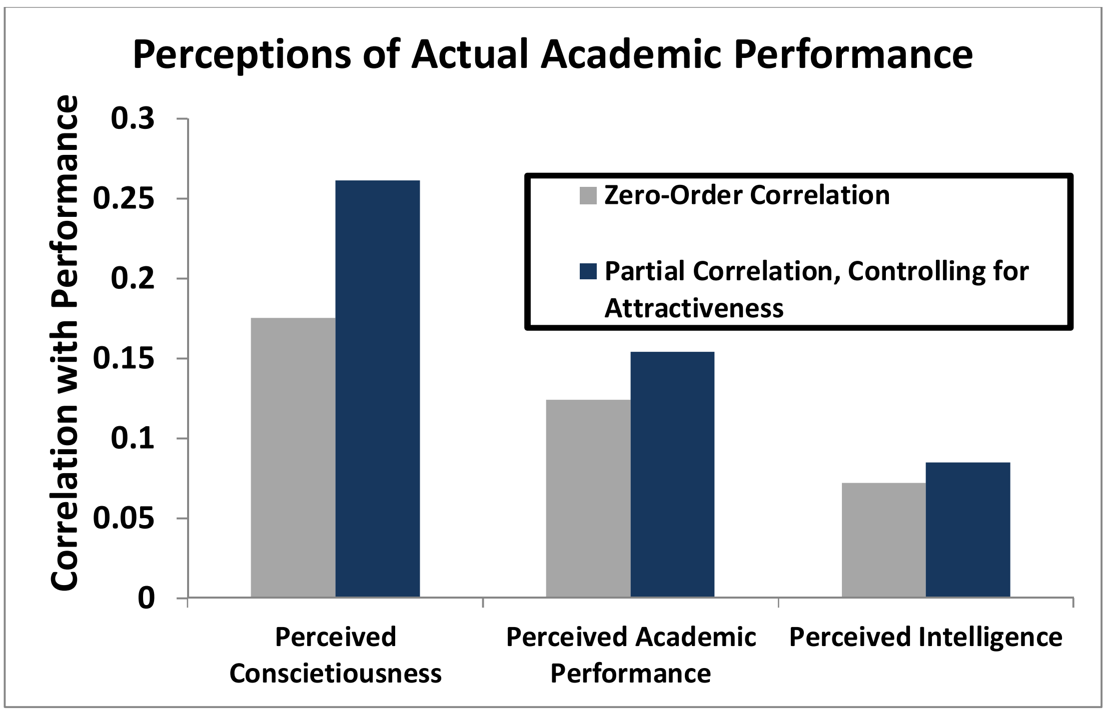


Figure 6.2. This bar graph shows the increased accuracy of the different perceived competence variables when controlling for perceived attractiveness. The same pattern emerges when controlling for the additional variables of sex and age of face.

[2] Findings do not change when controlling for only attractiveness in the partial correlation. Nor do they change when controlling for the combination of attractiveness and age or the combination of attractiveness and sex of face.

6.7 Discussion

There are three main findings. First, there was no first-order relationship between perceptions of conscientiousness, academic performance or intelligence and actual academic performance. Second, when controlling for the expected influences that age, sex and perceived attractiveness have on perceptions of competence (perceived conscientiousness, academic performance and intelligence), then the relation between perceived competence and actual academic performance increased in strength. Third, perceived conscientiousness was the single best face perception predictor of actual academic performance (outperforming perceived intelligence and perceived academic performance), and again accuracy was significantly improved when controlling for the suppressor variable of attractiveness.

As we expected, the form of the relationship is one of classic suppression in which there is some factor (perceived attractiveness) that is correlated with perceptions of conscientiousness, but not correlated with actual academic performance (Conger, 1974; Maassen & Bakker, 2001; MacKinnon et al., 2000; Mavor et al., 2009; Tzelgov & Henik, 1991). When this factor is controlled, the relationship between perceived conscientiousness and actual academic performance is increased (see Figure 6.3). It should also be noted that, although some previous literature suggests weak correlations between attractiveness and cognitive performance measures (Zebrowitz et al., 2002), in our study perceived attractiveness was not a valid cue to actual academic performance. These results suggest that we are ñblinded by beautyò in a way in which we would be more accurate in our perceptions of academic performance from faces if we were not influenced by the ñattractiveness haloò effect.

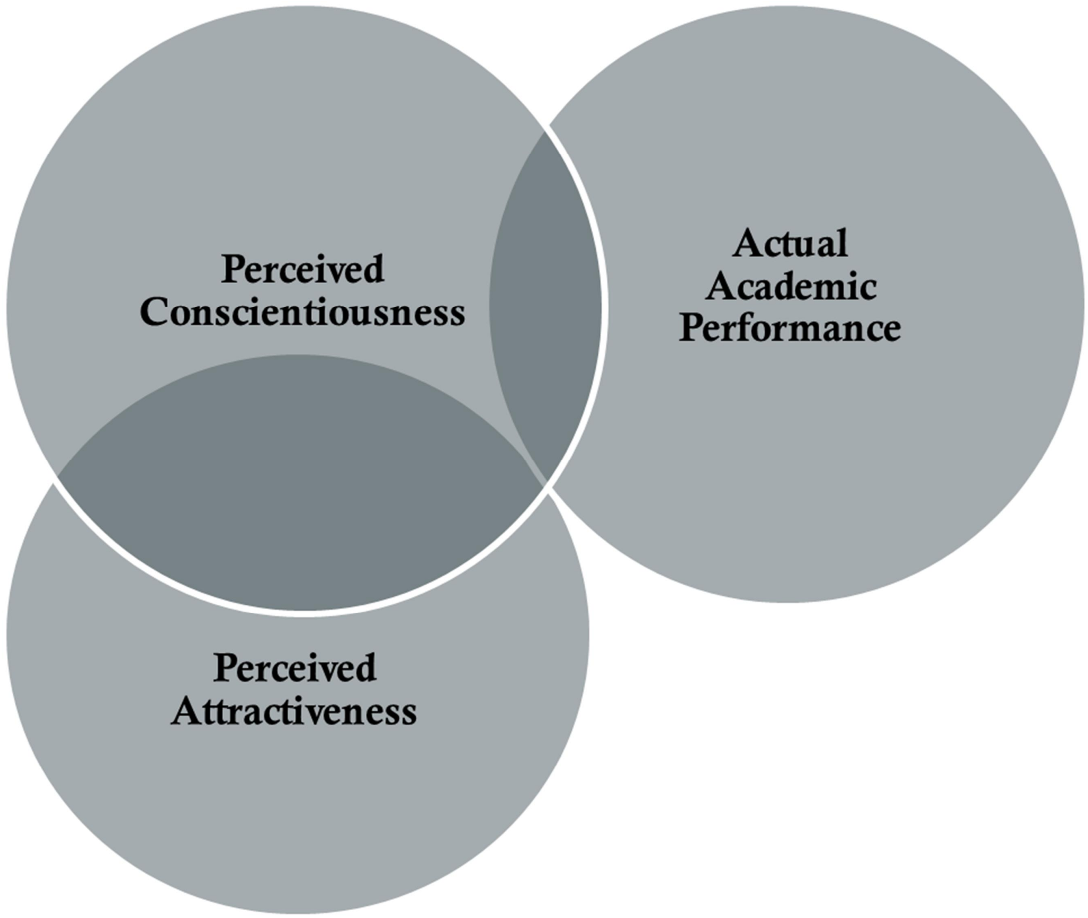


Figure 6.3.Suppression effect. This figure shows the noise in perceived conscientiousness (the overlap between perceived attractiveness and perceived conscientiousness) and how by suppressing this noise results in an improved predictor of actual academic performance (greater overlap between the remaining perceived conscientiousness and actual academic performance).

Given the amount of research on higher expectations and desired educational traits being ascribed to attractive students over unattractive students, it is not surprising that faces that were rated as more intelligent, having better academic performance and being more conscientious were also rated as more attractive (see composite faces in Figure 6.1). As predicted, there were high correlations between perceptions of attractiveness and perceptions of intelligence, conscientiousness, and academic performance, likely reflecting the strength of the attractiveness halo, as well as the similarities among these perceived competence measures (Todorov, Said, Engell, & Oosterhof, 2008). While there is less evidence to suggest perceptions of intelligence and academic performance are unique constructs, the possibility that perceived conscientiousness and perceived attractiveness are not distinguishable empirically is dealt with in two ways: face validity of the items for which evaluators were clearly rating conscientiousness or attractiveness (the measures were unambiguous to the evaluators); and we calculated inter-rater reliabilities for conscientiousness and attractiveness ratings and even after correcting for attenuation due to measurement error, the correlations between these variables remained distinct (i.e., they were imperfectly correlated). Taken together, these elements suggest that these measures can be treated here as distinct constructs, and that they are measured with sufficient reliability to be distinguished empirically in this study. The high correlations do create potential for interpretative difficulties in multiple regression, and under such circumstances we find it important to emphasize the role of suppression in their relationship in a way that reflects the traditional understanding of the attractiveness halo.

Findings suggest that accuracy in perceptions of academic performance also increases with the clarity and validity of the question proposed. When controlling for attractiveness, age and sex, perceptions of conscientiousness in faces yielded above chance accuracy in predicting academic performance, but accuracy in predicting actual academic performance did not reach levels of statistical significance with perceptions of intelligence or perceptions of academic performance. Given the high correlations between these perceived competence measures, it is difficult to say for certain whether perceptions of conscientiousness are unique in their capacity to predict actual academic performance over and above perceptions of intelligence or academic performance. Rather, it seems perceptions of conscientiousness predict actual academic performance because, in comparison, it may be the least ambiguous competence construct. As previously argued, it is likely that individual differences in theories and understandings of intelligence can lead, on average, to less accurate perceptions of intelligence in faces. Likewise, perceived academic performance is possibly confounded by a combination of the ambiguities in the term intelligence (fixed vs. malleable) and the limited consensus on how much intelligence (in relation to conscientiousness) is necessary for high academic performance; hence the limited accuracy of perceived academic performance compared to perceived conscientiousness in predicting actual academic performance.

The improved accuracy in perceived conscientiousness predicting actual academic performance over perceived intelligence is also consistent with research that suggests that actual conscientiousness is a stronger predictor of academic performance than actual intelligence (Chamorro-Premuzic, 2007). Further, the Intelligence Compensation Theory (ICT) suggests that conscientiousness acts as a coping strategy for relatively less intelligent people. While evidence for ICT is limited, some studies have found significant negative correlations between fluid intelligence and conscientiousness (Moutafi et al., 2003, 2004). Other studies have found a significant negative correlation between crystalized intelligence and conscientiousness (Wood & Englert, 2009). Thus, our findings of perceived conscientiousness better predicting actual academic performance in faces than perceived intelligence is consistent with literature suggesting actual conscientiousness is a better predictor than intelligence in predicting actual academic performance. Nonetheless, given the high correlations amongst the perceived competence variables explored (perceived intelligence, perceived academic performance and perceived conscientiousness), we must be cautious in claiming that only perceived conscientiousness is related to actual academic performance; rather, we argue that the specificity in rating tasks and the influence of attractiveness bias are worth considering when exploring validity of judgments based on faces.

The increased accuracy of academic performance in faces after controlling for attractiveness has important implications. Indeed, Olivola and Todorov (2010) showed that judges overweigh aspects of appearance and would be more accurate in judging personality if face perception was ignored. However, facial impressions have consistently been shown to influence our opinions as well as bias decisions in politics (Little, Roberts, Jones, & Burriss, 2007), leadership (Rule & Ambady, 2008), law (Zebrowitz & McDonald, 1991), parental expectations and punishments on children (Zebrowitz, Kendall-Tackett, & Fafel, 1991), military rank promotion (Mueller & Mazur, 1996), and teacher evaluations (Ambady & Rosenthal, 1993). Clearly, the power of first impressions is critical and has repeatedly been shown to influence our opinions about a person.

Furthermore, research has found that femininity is considered more attractive than masculinity (Perrett et al., 1998) and that females perform better academically and stay in education longer than males (Gurian & Stevens, 2004), which likely leads to females being ascribed more desired educational traits over men. It is also well documented that older students do better on intelligence tests (Cerella & Hale, 1994; Fry & Hale, 2000) and do better academically than younger students. Moreover, crystalized intelligence and perceptions of wisdom have shown to increase linearly with age (Clayton & Birren, 1980; Horn & Cattell, 1967), which would influence impressions of competence in older students (hence the intentionally limited university age range for facial stimuli presented). Our research suggests that when controlling for biases of attractiveness, age and sex, independently or collectively, accuracy of perceived academic performance is significantly improved.

Perhaps one of the most alarming consequences of using insufficient information to guide first impressions is the expectancy effect in education. The classic Pygmalion study conducted by Rosenthal and Jacobson (1968) suggests that expectations alone are capable of influencing the targetøs actual performance. Specifically, the Pygmalion study found that students who were arbitrarily assigned the label ñbloomersò (i.e., anticipated to show future promise) eventually scored higher on future tests than other students, even though the students labelled as ñbloomersò were a random sample and not any more intelligent than the other students in the class. More recent research on expectancy effects by Sorhagen (2013) found that teachersô inaccurate expectations of students in first grade was associated with studentsô academic performance in high-school and that students from lower-income families were especially influenced by this bias. Likewise, De Boer, Bosker, and Van Der Werf (2010) defined expectation bias as the difference between observed and predicted teacher expectation and found a significant relationship between teacherøs expectation bias of studentsô performance and actual performance five years later. Hence, perceptions of conscientiousness, intelligence, and academic performance may play a vital role in the classroom environment and in the success of a childøs education.

Future research in face perception can benefit from noting the significant differences in perception accuracy based on different theories of intelligence or competence. Perhaps more importantly, given the well-documented effects of expectations of academic performance on actual academic performance, our findings help emphasize the biased effects of perceived attractiveness on expectations of academic performance. While it seems unlikely that another personøs attractiveness can be filtered out when attempting to accurately perceive academic performance, the mere knowledge of the negative influence attractiveness has on accuracy may encourage less-biased practice; for perhaps the best antidote to deter unconscious bias is to make conscious the possibility of bias.

Chapter 7: Conclusions

7.1 Summary of Results

Previous studies have noted the strong relationship between perceptions of intelligence and attractiveness. While the attractiveness halo has positive influences on a range of other social judgments (e.g., trustworthiness, leadership), the influence of attractiveness on perceptions of intelligence was of particular interest in this thesis because of the impact of expectations of intelligence on studentsô actual academic performance (de Boer et al., 2010; Rosenthal & Jacobson, 1968). With special attention to the influence of attractiveness, this thesis explores cues to perceived intelligence, potentially accurate perceptions of competence, and individual susceptibility to the halo.

Chapter 4 introduces and validates new facial measurements to investigate malleable cues to perceptions of intelligence that are independent of the attractiveness halo. The cues of eyelid-openness and mouth curvature were specifically investigated given their relationship to sleep-deprivation and low mood, both of which have been associated with decreased cognitive ability (Ellis et al., 1984; Thomas et al., 2000). The findings described in Chapter 4 support the hypothesis that more eyelid-openness and upturned mouth curvature increase ratings of perceived intelligence independent of attractiveness. The eye and mouth shape influences on intelligence attribution were found for the faces of both adults and children. Both eyelid-openness and mouth curvature were confirmed to affect perceptions of intelligence using digital image manipulations in which only these shape cues were altered. Subtle differences in eyelid-openness and mouth curvature were also found to influence perceptions of intelligence within images of individuals before and after sleep restriction.

Chapter 5 extends research findings that perceived intelligence and attractiveness correlate by examining individual differences that may be related to the strength of this correlation. As predicted, our findings suggest that participants varied in the degree of endorsement of the perceived intelligence-attractiveness relationship, with participants who scored higher on intelligence tests being more likely to endorse the perceived intelligence-attractiveness halo. This influence of evaluator intelligence remained significant even when controlling for potential differences among individualsô scale use (standard deviation and mean of ratings for perceived intelligence and attractiveness).

Chapter 6 investigates the potential for individuals to assess academic performance accurately from facial images. While there was no relationship between actual academic performance and any of the perceived competence measures (perceived conscientiousness, perceived academic performance or perceived intelligence), the relation between perceived competence and actual academic performance increased in strength and became significant when controlling for the expected influences that age, sex, and perceived attractiveness have on perceptions of competence. Further, although other perceived competence measures (perceived academic performance, perceived intelligence) were highly correlated with perceived conscientiousness, perceived conscientiousness was the best face perception predictor of actual academic performance (outperforming perceived intelligence and perceived academic performance when controlling for attractiveness). This is interesting in light of previous research that shows that actual conscientiousness is a stronger predictor of academic performance than actual intelligence (Chamorro-Premuzic & Arteche, 2008; Chamorro-Premuzic, 2006, 2007).

7.2 Contributions, Limitations, and Future Work

The findings presented in this thesis highlight the strong relationship between perceptions of attractiveness and intelligence, using novel methods. Chapter 4 investigates the facial cues to alertness and to mood on perception by objectively measuring the eyelid-openness and mouth curvature of facial images. Perceptual studies in which participantsô ratings of eyelid-openness and mouth curvature significantly correlated with the calculated measurements, thus validating the objective measurements of eyelid-openness and mouth curvature. The influence of eyelid-openness and mouth curvature on perceptions of attractiveness and intelligence highlights the importance of considering (and perhaps controlling for) the impact these cues may have on other social judgments. For instance, given the well-established influence of valence on trait attributions like trustworthiness (see Oosterhof & Todorov, 2008), it may be beneficial to control for any influence of mouth curvature when investigating the possibility that other cues like facial width to height measures (Stirrat & Perrett, 2010) or family resemblance (Debruine, 2002) affect trustworthiness impression. Hence, controlling for mouth shape is particularly important in cases where mouth curvature may systematically relate to the variable of interest. For example, more dominant males may adopt a more down-turned mouth curvature during photography compared to less dominant males.

Similarly, an underlying assumption of most work investigating social judgments from facial images is that faces have a ñneutral expressionò, but by measuring subtle differences in mouth curvature and eyelid-openness, future research can more objectively ensure faces presented do not deviate significantly in regard to hints of positive or negative expression (as was done in Chapter 6). The use of measurements can also establish the relative importance of these shape cues when several cues can affect social judgments independently. For example, skin color, tiredness, demeanor, and level of adiposity may all contribute to judgments of apparent health.

As a further contribution, when investigating the role of mouth curvature and eyelid-openness on attributions, we directly manipulated these cues independently while keeping all other aspects of the face constant. While finding an effect of eyelid-openness and mouth curvature across natural images of adults and children and within the same individual after sleep-restriction was significant, the potential for these cues to be working in combination with each other or other cues was possible. Indeed, the direct manipulation of each cue independently allowed for stronger inferences about each cue than analysis of natural images alone.

Another key contribution stemming from Chapter 4ôs finding is that the cues of eyelid-openness and mouth curvature influence perceptions of intelligence *independent* of attractiveness. We ensured eyelid-openness and mouth curvature were not simply influencing perceived intelligence through their impact on attractiveness by conducting mediation analysis. Future research may consider using mediation analysis to examine the direct and indirect effects of particular facial cues on social judgments. For example, facial symmetry is known to influence perceptions of attractiveness and also be a significant predictor of actual intelligence (Banks et al., 2010; Miller, 2000; Penke et al., 2009); researchers might use mediation analysis to investigate whether facial symmetry is a cue to perceived intelligence independent of attractiveness.

Clearly, the influence of attractiveness on social judgments is robust. While much research (in addition to the research presented in this thesis) has established that people perceive faces they consider intelligent as attractive (and vice versa), Chapter 5 investigates this phenomenon at the individual level by creating a metric based on the correlation between a participantǿs ratings of attractiveness and ratings of perceived intelligence for a set of childrenǿs faces. While we used childrenǿs faces as stimuli because of the well-established influence of perceptions of childrenǿs intelligence on expectations and future academic performance, further research should examine the viability of oneǿs own intelligence influencing the endorsement of the perceived intelligence-attractiveness relationship in adults.

Additionally, while our findings suggest that individuals who scored higher on intelligence tests had a stronger endorsement of the perceived intelligence-attractiveness halo (or correlation), future research may benefit from investigating other individual differences that may influence endorsement of the intelligence-attractiveness halo, like own-attractiveness. Likewise, researchers might use a similar method to investigate the basis of age- or gender-biased stereotypes more generally. By measuring the association or correlation between face, gender or age and a social judgment (such as employability or suitability for leadership), one can determine the degree of bias at an individual level. As investigated in Chapter 5, further analysis can then be made of the extent to which a particular trait (own age, gender, education) is associated with sexism or ageism.

While attractiveness strongly relates to perceptions of intelligence, research suggests attractiveness and actual intelligence have no actual relationship (Mitchem et al., 2014). Indeed, this lack of validity makes it the attractiveness ñhaloò. Nonetheless, Chapter 6 finds that perceptions of competence correlated with actual academic performance, once we statistically controlled for the attractiveness halo, and that perceived conscientiousness correlated more strongly than perceived intelligence or perceived academic performance itself. These findings have important implications in relation to potentially accurate trait attributions from faces and helps emphasize the limiting effects of overgeneralizations. Future research may consider investigating whether perceptions of personality from facial stimuli alone would be more accurate if desired personality traits (agreeableness, conscientiousness, etc.) were not influenced by the attractiveness halo.

It is important to note that statistically controlling for an overgeneralization like attractiveness does not imply that a person can actually control for their bias and be more accurate, but rather emphasizes the point that overgeneralizations are typically blinding.

Future research is necessary to explore whether individuals can be less biased if they attempt to control for their own overgeneralizations. Indeed, literature suggests increasing self-control strength (through exercises like using oneҫs non-dominant hand or refraining from cursing) can reduce the effect of suppressing stereotypes (Gailliot, Plant, Butz, & Baumeister, 2007), yet such self-regulation takes effort (Gordijn, Hindriks, Koomen, Dijksterhuis, & Van Knippenberg, 2004; Richeson & Shelton, 2003; Richeson & Trawalter, 2005). Further, while all of the empirical studies in this thesis have potential implications in areas such as education and employment, the experiments presented are analogue studies that do not sample teachers or employers and as such, future research is needed to investigate these samples specifically.

Additionally, Chapter 6ҫs findings emphasize the significant differences among word usage in perceptual face rating tasks and accuracy of perceptions. While perceived conscientiousness, academic performance, and intelligence are related to perceived competence (and indeed are all highly correlated), specificity among these tasks resulted in increased accuracy. Collectively, research investigating judgment validity from facial images could benefit from examining specific perceptions (e.g., perceived blood pressure versus perceived health in assessing actual blood pressure) and controlling for well-known overgeneralizations to emphasize their limiting effects.

7.3 Final Conclusions

This thesis investigates the relationship between perceived intelligence and attractiveness with particular interest in implications in education, hiring, and other social judgments that are shaped by expectations and first impressions. The findings from Chapter 4 suggest that regardless of attractiveness, an individual can alter his or her perceived intelligence by changing eyelid-openness (by getting more sleep) and mouth curvature (by avoiding a subtle frown). Similarly, evidence from Chapter 5 suggests that individuals with higher intelligence may be more prone to an attractiveness halo effect, while Chapter 6 emphasizes the limiting effects of these types of overgeneralizations by showing that controlling for the attractiveness halo reveals better assessments of competence. In a next step, research could investigate these effects in a more natural environment (such as the classroom or workplace) and investigate whether awareness of the findings presented can alter behavior and perceptions for the better.

References

Alaimo, K., Olson, C. M., & Frongillo Jr, E. A. (2001). Food insufficiency and American school-aged childrenôs cognitive, academic, and psychosocial development. *Pediatrics*, *108*(1), 44ï 53.

Alaluf, S., Heinrich, U., Stahl, W., Tronnier, H., & Wiseman, S. (2002). Dietary carotenoids contribute to normal human skin color and UV photosensitivity. *The Journal of Nutrition*, *132*(3), 399ï 403.

Alexander, R. (1979). *Darwinism and human affairs*. Seattle: University of Washington Press.

Alley, T. R., & Cunningham, M. R. (1991). Averaged faces are attractive, but very attractive faces are not average. *Psychological Science*, *2*(2), 123ï 125. doi:10.1111/j.1467-9280.1991.tb00113.x

Alrajih, S., & Ward, J. (2013). Increased facial width-to-height ratio and perceived dominance in the faces of the UKôs leading business leaders. *British Journal of Psychology*, 1ï 9. doi:10.1111/bjop.12035

Alvergne, A., Faurie, C., & Raymond, M. (2009). Fatherï offspring resemblance predicts paternal investment in humans. *Animal Behaviour*, *78*(1), 61ï 69. doi:10.1016/j.anbehav.2009.03.019

Alvidrez, J., & Weinstein, R. S. (1999). Early teacher perceptions and later student academic achievement. *Journal of Educational Psychology*, *91*(4), 731ï 746.

Ambady, N., & Rosenthal, R. (1993). Half a minute: Predicting teacher evaluations from thin slices of nonverbal behavior and physical attractiveness. *Journal of Personality and Social Psychology*, *64*(3), 431ï 441. doi:10.1037/0022-3514.64.3.431

Anderson, D., & Rosenthal, R. (1968). Some effects of interpersonal expectancy and social interaction on institutionalized retarded children. *Proceedings of the 76th Annual Convention of the American Psychological Association*, *3*, 479ï 480.

Arden, R., Gottfredson, L. S., & Miller, G. F. (2009). Does a fitness factor contribute to the association between intelligence and health outcomes? Evidence from medical abnormality counts among 3654 US Veterans. *Intelligence*, *37*(6), 581ï 591. doi:10.1016/j.intell.2009.03.008

Arden, R., Gottfredson, L. S., Miller, G. F., & Pierce, A. (2009). Intelligence and semen quality are positively correlated. *Intelligence*, *37*(3), 277ï 282. doi:10.1016/j.intell.2008.11.001

Armstrong, N., & Welsman, J. R. (2001). Peak oxygen uptake in relation to growth and maturation in 11- to 17-year-old humans. *European Journal of Applied Physiology*, *85*, 546ï 551. doi:10.1007/s004210100485

Aronson, E. (1969). The theory of cognitive dissonance: A current perspective. *Advances in Experimental Social Psychology*, *4*, 1ï 34. doi:10.1016/S0065-

2601(08)60075-1

Asch, S. E. (1946). Forming impressions of personality. *Journal of Abnormal Psychology*, *41*(3), 258ï 290. doi:10.1037/h0060423

Axelsson, J., Sundelin, T., Ingre, M., Someren, E. J. W. Van, Olsson, A., & Lekander, M. (2010). Beauty sleep: experimental study on the perceived health and attractiveness of sleep deprived people. *British Medical Journal*, *341*(c6614), 1ï 5. doi:10.1136/bmj.c6614

Babad, E. Y., Inbar, J., & Rosenthal, R. (1982). Pygmalion, Galatea, and the Golem: Investigations of biased and unbiased teachers. *Journal of Educational Psychology*, *74*(4), 459ï 474.

Bakker, T. C. M., Zunzler, R., & Mazzi, D. (1999). Condition-related mate choice in sticklebacks. *Nature*, *401*, 255ï 257.

Banks, G. C., Batchelor, J. H., & McDaniel, M. a. (2010). Smarter people are (a bit) more symmetrical: A meta-analysis of the relationship between intelligence and fluctuating asymmetry. *Intelligence*, *38*(4), 393ï 401. doi:10.1016/j.intell.2010.04.003

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

Barber, I., Arnott, S., Braithwaite, V., Andrew, J., & Huntingford, F. (2001). Indirect fitness consequences of mate choice in sticklebacks: offspring of brighter males grow slowly but resist parasitic infections. *Proceedings Royal Society of London B*, *268*(1462), 71ï 76. doi:10.1098/rspb.2000.1331

Bartels, M., Rietveld, M., Van Baal, G., & Boomsma, D. (2002). Genetic and environmental influences on the development of intelligence. *Behavior Genetics*, *32*(4), 237ï 249.

Bates, T. C. (2007). Fluctuating asymmetry and intelligence. *Intelligence*, *35*(1), 41ï 46. doi:doi: DOI: 10.1016/j.intell.2006.03.013

Batres, C., & Perrett, D. I. (2014). The influence of the digital divide on face preferences in El Salvador: People without internet access prefer more feminine men, more masculine women, and women with higher adiposity. *PLoS ONE*, *9*(7). doi:10.1371/journal.pone.0100966

Batty, G. D., Deary, I. J., & Gottfredson, L. S. (2007). Premorbid (early life) IQ and later mortality risk: Systematic review. *Annals of Epidemiology*, *17*(4), 278ï 288. doi:10.1016/j.annepidem.2006.07.010

Beloff, H. (1992). Mother, father and me: Our IQ. *The Psychologist*, *5*, 309ï 311.

Benson, P., & Perrett, D. I. (1992). Face to face with the perfect image. *New Scientist*, *133*(1809), 32ï 35.

Benson, P., & Perrett, D. I. (1993). Extracting prototypical facial images from exemplars. *Perception*, *22*, 257ï 262. doi:10.1068/p220257n

Bestelmeyer, P. E. G., Jones, B. C., Debruine, L. M., Little, A. C., Perrett, D. I., Schneider, A., é Conway, C. A. (2008). Sex-contingent face aftereffects depend on perceptual category rather than structural encoding. *Cognition*, *107*(1), 353ï 365. doi:10.1016/j.cognition.2007.07.018

Bishop, S. J. (2009). Trait anxiety and impoverished prefrontal control of attention. *Nature Neuroscience*, *12*(1), 92ï 98. doi:10.1038/nn.2242

Blackwell, L. S., Trzesniewski, K. H., & Dweck, C. S. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: a longitudinal study and an intervention. *Child Development*, *78*(1), 246ï 63. doi:10.1111/j.1467-8624.2007.00995.x

Blau, P. (1968). Social exchange. *International Encyclopedia of the Social Sciences*, *7*, 452ï 457.

Blount, B. C., Mack, M. M., Wehr, C. M., MacGregor, J. T., Hiatt, R. A., Wang, G., é Ames, B. N. (1997). Folate deficiency causes uracil misincorporations into human DNA and chromosome breakage: implications for cancer and neuronal damage. *Proceedings of the National Academy of Sciences of the United States of America*, *94*(7), 3290ï 3295. doi:10.1073/pnas.94.7.3290

Boothroyd, L. G., Scott, I. M. L., Gray, A. W., Coombes, C. I., & Pound, N. (2013). Male facial masculinity as a cue to health outcomes. *Evolutionary Psychology*, *11*(5), 1044ï 1058. doi:10.1063/1.2756072

Borkenau, P., Brecke, S., Möttig, C., & Paelecke, M. (2009). Extraversion is accurately perceived after a 50-ms exposure to a face. *Journal of Research in Personality*, *43*(4), 703ï 706. doi:10.1016/j.jrp.2009.03.007

Borkenau, P., & Liebler, A. (1992). Trait inferences: Sources of validity at zero acquaintance. *Journal of Personality and Social Psychology*, *62*(4), 645ï 657.

Bressan, P., & Martello, M. F. D. (2002). Talis pater, talis filius: perceived resemblance and the belief in genetic relatedness. *Psychological Science*, *13*(3), 213ï 218. doi:10.1111/1467-9280.00440

Brophy, J. E. (1985). Teacher-student interaction. *Teacher Expectancies*, 308ï 328.

Bushnell, I. (2001). Motherôs face recognition in newborn infants: Learning and memory. *Infant and Child Development*, *10*, 67ï 74. doi:10.1002/icd.248

Buss, D. M. (1985). Human mate selection: Opposites are sometimes said to attract, but in fact we are likely to marry someone who is similar to us in almost every variable. *American Scientist*, *73*(1), 47ï 51. doi:10.2307/27853061

Buss, D. M. (1989). Sex differences in human mate preferences: Evolutionary hypotheses tested in 37 cultures. *Behavioral and Brain Sciences*, *12*(1), 1ï 14. doi:10.1017/S0140525X00023992

Byrd, M., & Stacey, B. (1993). Bias in IQ perception. *The Psychologist*, *6*, 1ï 16.

Byrne, D. (1961). Interpersonal attraction and attitude similarity. *Journal of Abnormal and Social Psychology*, *62*(3), 713ï 715.

Byrne, D., Clore, G. L., & Smeaton, G. (1986). The attraction hypothesis: Do similar attitudes affect anything? *Journal of Personality and Social Psychology*, *51*(6), 1167ï 1170.

Byrne, D., London, O., & Reeves, K. (1968). The effects of physical attractiveness, sex, and attitude similarity on interpersonal attraction. *Journal of Personality*, *36*(2), 259ï 271.

Byrne, D., & Nelson, D. (1965). Attraction as a linear function of proportion of positive reinforcements. *Journal of Personality and Social Psychology, 1*(6), 659ï 663. doi:10.1037/h0022073

Cameron, C., Oskamp, S., & Sparks, W. (1977). Courtship American style: newspaper ads. *The Family Coordinator*, *26*(1), 27ï 30. doi:10.2307/581857

Campbell, R. T. (1979). The relationship between childrenôs perceptions of ability and perceptions of physical attractiveness: Comment on Felson and Bohrnstedt's ñAre the good beautiful or the beautiful good?ò *Social Psychology Quarterly, 42*(4), 393ï 398. doi:10.2307/3033808

Candolin, U. (2003). The use of multiple cues in mate choice. *Biological Reviews of the Cambridge Philosophical Society*, *78*(4), 575ï 595. doi:10.1017/S1464793103006158

Capron, C., & Duyme, M. (1989). Assessment of effects of socio-economic status on IQ in a full cross-fostering study. *Nature, 340*(6230), 552ï 554. doi:doi:10.1038/342174a0

Carré, J. M., & McCormick, C. M. (2008). In your face: facial metrics predict aggressive behaviour in the laboratory and in varsity and professional hockey players. *Proceedings of the Royal Society B: Biological Sciences*, *275*(1651), 2651ï 2656. doi:10.1098/rspb.2008.0873

Carré, J. M., McCormick, C. M., & Mondloch, C. J. (2009). Facial structure is a reliable cue of aggressive behavior: Research report. *Psychological Science*, *20*(10), 1194ï 1198. doi:10.1111/j.1467-9280.2009.02423.x

Carré, J. M., Morrissey, M. D., Mondloch, C. J., & McCormick, C. M. (2010). Estimating aggression from emotionally neutral faces: Which facial cues are diagnostic? *Perception*, *39*(3), 356ï 377. doi:10.1068/p6543

Carroll, J. B. (1993). *Human Cognitive Abilities*. New York: Cambrdige University Press. doi:10.1017/CBO9780511571312

Carter, H., & Glick, P. (1976). Marriage and divorce: a social and economic study. Rev. ed.

Cattell, R. B. (1940). A culture-free intelligence test. I. *Journal of Educational Psychology*, *31*(3), 161ï 179. doi:10.1037/h0059043

Cattell, R. B. (1963). Theory of fluid and crystallized intelligence. *Journal of Educational Psycholgoy*, *54*(1), 1ï 22. doi:10.1037/h0046743

Cattell, R. B., Feingold, S. N., & Sarason, S. B. (1941). A culture-free intelligence test: II. Evaluation of cultural influence on test performance. *Journal of Educational Psychology*, *32*(2), 81ï 100. doi:10.1037/h0058456

Cattell, R. B., & Galton, F. (1890). V . Mental tests and measurements, 373ï 381.

Cerella, J., & Hale, S. (1994). The rise and fall in information-processing rates over the life span. *Acta Psychologica*, *86*(2-3), 109ï 197. doi:10.1016/0001-6918(94)90002-7

Chamorro-Premuzic, T. (2006). Creativity versus conscientiousness: Which is a better predictor of student performance? *Applied Cognitive Psychology*, *20*(4), 521ï 531. doi:10.1002/acp.1196

Chamorro-Premuzic, T. (2007). *Personality and individual differences.* Malden: Blackwell Publishing.

Chamorro-Premuzic, T., & Arteche, A. (2008). Intellectual competence and academic performance: Preliminary validation of a model. *Intelligence*, *36*(6), 564ï 573. doi:10.1016/j.intell.2008.01.001

Chamorro-Premuzic, T., & Furnham, A. (2004). A possible model for understanding the personality--intelligence interface. *British Journal of Psychology*, *95*, 249ï 264. doi:10.1348/000712604773952458

Claiborn, W. L. (1969). Expectancy effects in the classroom: A failure to replicate. *Journal of Educational Psychology*, *60*(5), 377ï 383. doi:10.1037/h0028320

Clayton, V., & Birren, J. (1980). The development of wisdom across the life span: A reexamination of an ancient topic. *Life-Span Development and Behavior*, *3*, 103ï 135.

Clifford, M. M. (1975). Physical attractiveness and academic performance. *Child Study Journal*, *5*(4), 201ï 209.

Clifford, M. M., & Walster, E. (1973). The effect of physical attractiveness on teacher expectations. *Sociology of Education*, *46*(2), 248ï 258.

Coetzee, V., Chen, J., Perrett, D. I., & Stephen, I. D. (2010). Deciphering faces: Quantifiable visual cues to weight. *Perception*, *39*(1), 51ï 61. doi:10.1068/p6560

Coetzee, V., Perrett, D. I., & Stephen, I. D. (2009). Facial adiposity: A cue to health? *Perception*, *38*(11), 1700ï 1711. doi:10.1068/p6423

Condon, D. M., & Revelle, W. (2014). The international cognitive ability resource: Development and initial validation of a public-domain measure. *Intelligence*, *43*, 52ï 64. doi:10.1016/j.intell.2014.01.004

Conger, A. J. (1974). A revised definition for suppressor variables: A guide to their identification and interpretation. *Educational and Psychological Measurement*, *34*(1), 35ï 46. doi:10.1177/001316447403400105

Conway, C. A., Jones, B. C., Debruine, L. M., & Little, A. C. (2010). Sexual dimorphism of male face shape, partnership status and the temporal context of relationship sought modulate womenôs preferences for direct gaze. *British Journal of Psychology*, *101*(1), 109ï 21. doi:10.1348/000712609X436435

Conway, C. A., Jones, B. C., Debruine, L. M., Little, A. C., Hay, J., Welling, L. L. M., é Feinberg, D. R. (2008). Integrating physical and social cues when forming face preferences: differences among low and high-anxiety individuals. *Social Neuroscience*, *3*(1), 89ï 95. doi:10.1080/17470910701676145

Cunningham, M. R. (1986). Measuring the physical in physical attractivenessҙ Quasiexperiments on the sociobiology of female facial beauty. *Journal of Personality and Social Psychology*, *50*(5), 925ï 935.

Cunningham, M. R., Barbee, A. P., & Pike, C. L. (1990). What do women want? Facialmetric assessment of multiple motives in the perception of male facial physical attractiveness. *Journal of Personality and Social Psychology*, *59*(1), 61ï 72.

Dalrymple, K. A., Gomez, J., & Duchaine, B. (2013). The Dartmouth database of childrenĝs faces: Acquisition and validation of a new face stimulus set. *PLoS ONE*, *8*(11), 1ï 7. doi:10.1371/journal.pone.0079131

Davies, R. (1951). *Tempest-Tost*. Penguin Classics.

de Boer, H., Bosker, R. J., & van der Werf, M. P. C. (2010). Sustainability of teacher expectation bias effects on long-term student performance. *Journal of Educational Psychology*, *102*(1), 168ï 179. doi:10.1037/a0017289

De Haan, M., Johnson, M. H., Maurer, D., & Perrett, D. I. (2001). Recognition of individual faces and average face prototypes by 1- and 3-month-old infants. *Cognitive Development*, *16*(2), 659ï 678. doi:10.1016/S0885-2014(01)00051-X

Deary, I. J., Spinath, F. M., & Bates, T. C. (2006). Genetics of intelligence. *European Journal of Human Genetics*, *14*(6), 690ï 700. doi:10.1038/sj.ejhg.5201588

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

Debruine, L. M., Jones, B. C., Crawford, J. R., Welling, L. L. M., & Little, A. C. (2010). The health of a nation predicts their mate preferences: cross-cultural variation in womenĝs preferences for masculinized male faces. *Proceedings of the Royal Society B: Biological Sciences*, *277*(1692), 2405ï 2410. doi:10.1098/rspb.2009.2184

Debruine, L. M., Jones, B. C., & Perrett, D. I. (2005). Womenĝs attractiveness judgments of self-resembling faces change across the menstrual cycle. *Hormones and Behavior*, *47*(4), 379ï 83. doi:10.1016/j.yhbeh.2004.11.006

DeBruine, L. M., Jones, B. C., Tybur, J. M., Lieberman, D., & Griskevicius, V. (2010). Womenĝs preferences for masculinity in male faces are predicted by pathogen disgust, but not by moral or sexual disgust. *Evolution and Human Behavior*, *31*(1), 69ï 74. doi:10.1016/j.evolhumbehav.2009.09.003

Debruine, L. M., Jones, B. C., Unger, L., Little, A. C., & Feinberg, D. R. (2007). Dissociating averageness and attractiveness: attractive faces are not always average. *Journal of Experimental Psychology: Human Perception and Performance*, *33*(6), 1420ï 1430. doi:10.1037/0096-1523.33.6.1420

Denny, K. (2008). Beauty and intelligence may or may not be related. *Intelligence*, *36*(6), 616ï 618.

Devine, P. G. (1989). Stereotypes and prejudice: Their automatic and controlled components. *Journal of Personality and Social Psychology*, *56*(1), 5ï 18. doi:10.1037/0022-3514.56.1.5

Dion, K., Berscheid, E., & Walster, E. (1972). What is beautiful is good. *Journal of Personality and Social Psychology*, *24*(3), 285ï 90.

Dusek, J. B., & Joseph, G. (1983). The bases of teacher expectancies: A meta-analysis. *Journal of Educational Psychology*, *75*(3), 327ï 346. doi:10.1037/0022-0663.75.3.327

Dweck, C. S., Chiu, C., & Hong, Y. (1995). Implicit theories and their role in judgments and reactions: A word from two perspectives. *Psychological Inquiry*, *6*(4), 267ï 285. doi:10.1207/s15327965pli0604_1

Dweck, C. S., & Henderson, V. L. (1989). Theories of intelligence: background and measures.

Eagly, A. H., Ashmore, R. D., Makhijani, M. G., & Longo, L. C. (1991). What is beautiful is good, but: A meta-analytic review of research on the physical attractiveness stereotype. *Psychological Bulletin*, *110*(1), 109ï 128.

Edwards, E., & Duntley, S. (1939). The pigments and color of living human skin. *American Journal of Anatomy*, *65*(1), 1ï 33.

Elfenbein, H. A., & Ambady, N. (2002). Is there an in-group advantage in emotion recognition? *Psychological Bulletin*, *128*(2), 243ï 249. doi:10.1037/0033-2909.128.2.243

Elfenbein, H. A., & Ambady, N. (2003). When familiarity breeds accuracy: cultural exposure and facial emotion recognition. *Journal of Personality and Social Psychology*, *85*(2), 276ï 290. doi:10.1037/0022-3514.85.2.276

Ellis, H. C., Thomas, R. L., & Rodriguez, I. A. (1984). Emotional mood states and memory: elaborative encoding, semantic processing, and cognitive effort. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *10*(3), 470ï 82.

Enlow, D. H., & Hans, M. G. (1996). *Essentials of facial growth.* Philadelphia: W.B Saunders Company.

Eysenck, M. W., Derakshan, N., Santos, R., & Calvo, M. G. (2007). Anxiety and cognitive performance: attentional control theory. *Emotion*, *7*(2), 336ï 353. doi:10.1037/1528-3542.7.2.336

Feinberg, D. R., Jones, B. C., DeBruine, L. M., Moore, F. R., Law Smith, M. J., Cornwell, R. E., é Perrett, D. I. (2005). The voice and face of woman: One ornament that signals quality? *Evolution and Human Behavior*, *26*(5), 398ï 408. doi:10.1016/j.evolhumbehav.2005.04.001

Felson, R. B. (1980). Physical attractiveness, grades and teachersô attributions of ability. *Representative Research in Social Psychology*, *11*(1), 64ï 71.

Felson, R. B., & Bohrnstedt, G. W. (1979). ñAre the good beautiful or the beautiful good?ò The relationship between childrenôs perceptions of ability and perceptions of physical attractiveness. *Social Psychology Quarterly*, *42*(4), 386ï 392. doi:10.2307/3033808

Festinger, L. (1962). *A theory of cognitive dissonance*. Stanford University Press.

Fink, B., Grammer, K., & Matts, P. J. (2006). Visible skin color distribution plays a role in the perception of age, attractiveness, and health in female faces. *Evolution and Human Behavior*, *27*(6), 433ï 442. doi:10.1016/j.evolhumbehav.2006.08.007

Fink, B., Grammer, K., Mitteroecker, P., Gunz, P., Schaefer, K., Bookstein, F. L., & Manning, J. T. (2005). Second to fourth digit ratio and face shape. *Proceedings Royal Society of London B*, *272*(1576), 1995ï 2001. doi:10.1098/rspb.2005.3179

Fink, B., Grammer, K., & Thornhill, R. (2001). Human (Homo sapiens) facial attractiveness in relation to skin texture and color. *Journal of Comparative Psychology*, *115*(1), 92ï 99. doi:10.1037//0735-7036.115.1.92

Fink, B., Neave, N., Manning, J. T., & Grammer, K. (2006). Facial symmetry and judgements of attractiveness, health and personality. *Personality and Individual Differences*, *41*(3), 491ï 499. doi:10.1016/j.paid.2006.01.017

Fink, B., Neave, N., & Seydel, H. (2007). Male facial appearance signals physical strength to women. *American Journal of Human Biology*, *19*(1), 82ï 87. doi:10.1002/ajhb.20583

Fink, B., & Penton-Voak, I. S. (2002). Evolutionary psychology of facial attractiveness. *Current Directions in Psychological Science*, *11*(5), 154ï 158. doi:10.1111/1467-8721.00190

Fisher, C. I., Hahn, A. C., Debruine, L. M., & Jones, B. C. (2014). Integrating shape cues of adiposity and color information when judging facial health and attractiveness. *Perception*, *43*(6), 499ï 508. doi:10.1068/p7728

Fisher, R. A. (1915). The evolution of sexual preference. *The Eugenics Review*, *7*(3), 184ï 192.

Flegal, K. M., Graubard, B. I., Williamson, D. F., & Gail, M. H. (2005). Underweight, overweight, and obesity. *Mortality*, *293*(15), 1861ï 1867. doi:10.1001/jama.293.15.1861

Friis, H., Gomo, E., Koestel, P., Ndhlovu, P., Nyazema, N., Krarup, H., & Michaelsen, K. F. (2001). HIV and other predictors of serum folate, serum ferritin, and hemoglobin in pregnancy: a cross-sectional study in Zimbabwe. *The American Journal of Clinical Nutrition*, *73*(6), 1066ï 73.

Fry, A. F., & Hale, S. (2000). Relationships among processing speed, working memory, and fluid intelligence in children. *Biological Psychology*, *54*(1-3), 1ï 34.

Furlow, F. B., Armijo-Prewitt, T., Gangestad, S. W., & Thornhill, R. (1997). Fluctuating asymmetry and psychometric intellingence. *Proceedings Royal Society of London B*, *264*, 823ï 829.

Furnham, A., & Bachtiar, V. (2008). Personality and intelligence as predictors of creativity. *Personality and Individual Differences*, *45*(7), 613ï 617. doi:10.1016/j.paid.2008.06.023

Furnham, A., & Baguma, P. (1994). Cross-cultural differences in the perception of male and female body shapes as a function of exercise. *Journal of Social Behavior and Personality*, *15*(1), 81ï 89.

Furnham, A., Boo, H. C., & McClelland, A. (2012). Individual Differences and the

Susceptibility to the Influence of Anchoring Cues. *Journal of Individual Differences*, *33*(2), 89ï 93. doi:10.1027/1614-0001/a000076

Furnham, A., & Chamorro-Premuzic, T. (2004). Estimating oneôs own personality and intelligence scores. *British Journal of Psychology*, *95*(October), 149ï 160. doi:10.1348/000712604773952395

Furnham, A., & Rawles, R. (1995). Sex differences in the estimation of intelligence. *Journal of Social Behavior & Personality*, *10*(3), 741ï 748.

Furnham, A., & Rawles, R. (1999). Correlations between self-estimated and psychometrically measured IQ. *The Journal of Social Psychology*, *139*(4), 405ï 140. doi:10.1080/00224549909598400

Furnham, A., Reeves, E., & Budhani, S. (2002). Parents think their sons are brighter than their daughters: sex differences in parental self-estimations and estimations of their childrenôs multiple intelligences. *The Journal of Genetic Psychology*, *163*(1), 24ï 39. doi:10.1080/00221320209597966

Gailliot, M. T., Plant, E. A., Butz, D. A., & Baumeister, R. F. (2007). Increasing self-regulatory strength can reduce the depleting effect of suppressing stereotypes. *Personality and Social Psychology Bulletin*, *33*(2), 281ï 294. doi:10.1177/0146167206296101

Galton, F. (1878). Composite portraits, made by combining those of many different persons into a single resultant figure. *The Journal of the Anthropological Institute of Great Britain and Ireland*, *8*(3), 132ï 144.

Gardner, H. E. (1983). *Frames of mind: The theory of multiple intelligences*. New York: Basic Books.

Gardner, H. E. (2000). *Intelligence Reframed: Multiple Int.* New York: Basic Books.

Gehrman, P. R., Meltzer, L. J., Moore, M., Pack, A. I., Perlis, M. L., Eaves, L. J., & Silberg, J. L. (2011). Heritability of insomnia symptoms in youth and their relationship to depression and anxiety. *Sleep*, 4ï 9. doi:10.5665/sleep.1424

Geniole, S. N., Keyes, A. E., Mondloch, C. J., Carré, J. M., & McCormick, C. M. (2012). Facing aggression: Cues differ for female versus male faces. *PLoS ONE*, *7*(1), 1ï 12. doi:10.1371/journal.pone.0030366

Germine, L., Russell, R., Bronstad, P. M., Blokland, G. A. M., Smoller, J. W., Kwok, H., é Wilmer, J. B. (2015). Individual aesthetic preferences for faces are shaped mostly by environments, not genes. *Current Biology*, *25*, 2684ï 2689. doi:10.1016/j.cub.2015.08.048

Gildersleeve, K., DeBruine, L., Haselton, M. G., Frederick, D. A., Penton-Voak, I. S., Jones, B. C., & Perrett, D. I. (2013). Shifts in womenôs mate preferences across the ovulatory cycle: A critique of Harris (2011) and Harris (2012). *Sex Roles*, *69*(9-10), 516ï 524. doi:10.1007/s11199-013-0273-4

Gildersleeve, K., Haselton, M. G., & Fales, M. R. (2014). Do womenôs mate preferences change across the ovulatory cycle? A meta-analytic review. *Psychological Bulletin*, *140*(2), 1205ï 1259. doi:10.1037/a0035438

Ginsburg, E., Livshits, G., Yakovenko, E., & Kobyliansky, K. (1998). Major gene control of human body height , weight and BMI in five ethnically. *Annual Human Genetics*, *62*, 307ï 322.

Gómez-Valdés, J., Hünemeier, T., Quinto-Sánchez, M., Paschetta, C., de Azevedo, S., González, M. F., é González-José, R. (2013). Lack of support for the association between facial shape and aggression: a reappraisal based on a worldwide population genetics perspective. *PLoS ONE*, *8*(1), e52317. doi:10.1371/journal.pone.0052317

Gordijn, E. H., Hindriks, I., Koomen, W., Dijksterhuis, A., & Van Knippenberg, A. (2004). Consequences of stereotype suppression and internal suppression motivation: a self-regulation approach. *Personality & Social Psychology Bulletin*, *30*(2), 212ï 24. doi:10.1177/0146167203259935

Gottfredson, L. S. (2003). On Sternbergõs ñReply to Gottfredson.ò *Intelligence*, *31*(4), 415ï 424. doi:10.1016/S0160-2896(03)00024-2

Gottfredson, L. S., & Deary, I. J. (2004). Intelligence longevity, predicts but and why? *Current Directions in Psychological Science*, *13*(1), 1ï 4.

Grammer, K., Fink, B., Möller, A. P., & Thornhill, R. (2003). Darwinian aesthetics: sexual selection and the biology of beauty. *Biological Reviews*, *78*(3), 385ï 407. doi:10.1017/S1464793102006085

Grammer, K., & Thornhill, R. (1994). Human (Homo sapiens) facial attractiveness and sexual selection: The role of symmetry and averageness. *Journal of Comparative Psychology*, *108*(3), 233ï 242. doi:10.1037/0735-7036.108.3.233

Gregg, E. W. (2000). Is diabetes associated with cognitive impairment and cognitive decline among older women? *Archives of Internal Medicine*, *160*(2), 174ï 180. doi:10.1001/archinte.160.2.174

Gross, A., & Crofton, C. (1977). What is good is beautiful. *American Sociological Association*, *40*(1), 85ï 90. doi:10.1037/h0033731

Guilford, J. P. (1959). Three faces of intellect. *American Psychologist*, *14*(8), 469ï 479. doi:10.1037/h0046827

Guilford, J. P. (1977). *Way behond the IQ: Guide to improving intelligence and creativity*. Buffalo, NY: Creative Education Foundation.

Gurian, M., & Stevens, K. (2004). With boys and girls in mind. *Educational Leadership*, *62*(3), 21ï 26.

Guthrie, R. (1970). Evolution of human threat display organs. *Evolutionary Biology*, *4*, 257ï 302.

Haines, M. M., Stansfeld, S., Job, R. F., Berglund, B., & Head, J. (2001). Chronic aircraft noise exposure, stress responses, mental health and cognitive performance in school children. *Psychological Medicine*, *31*(2), 265ï 277. doi:10.1017/S0033291701003282

Hamilton, W. D. (1964). The genetical evolution of social behaviour. *Journal of Theoretical Biology*, *7*(1), 1ï 16. doi:10.1016/0022-5193(64)90038-4

Hamilton, W. D., & Zuk, M. (1982). Heritable true fitness and bright birds¿ A role for parasites¿ *Science*, *218*(4570), 384ï 387.

Haselhuhn, M. P., & Wong, E. M. (2012). Bad to the bone: Facial structure predicts unethical behaviour. *Proceedings of the Royal Society B: Biological Sciences*, *279*(1728), 571ï 576. doi:10.1098/rspb.2011.1193

Hatfield, E., Traupmann, J., & Sprecher, S. (1985). Equity and intimate relations: Recent research. In *Compatible and Incompatible Relationships* (pp. 91ï 117). New York: Springer.

Hatfield, E., Walster, E., Walster, G., & Berscheid, E. (1978). *Equity: Theory and research*. Allyn & Bacon.

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. *New York, NY: Guilford*.

Hehman, E., Flake, J. K., & Freeman, J. B. (2015). Static and dynamic facial cues differentially affect the consistency of social evaluations. *Personality and Social Psychology Bulletin*, *41*(8), 1123ï 1134. doi:10.1177/0146167215591495

Hinnant, J. B., OôBrien, M., & Ghazarian, S. R. (2009). The longitudinal relations of teacher expectations to achievement in the early school years. *Journal of Educational Psychology*, *101*(3), 662ï 670. doi:10.1037/a0014306

Hoge, R. D., & Coladarci, T. (1989). Teacher-based judgments of academic achievement: A review of literature. *Review of Educational Research*, *59*(3), 297ï 313.

Holmes, W., & Sherman, P. (1982). The ontogeny of kin recognition in two species of ground squirrels. *American Zoologist*, *22*(3), 491ï 517.

Holtzman, N. S. (2011). Facing a psychopath: Detecting the dark triad from emotionally-neutral faces, using prototypes from the Personality Faceaurus. *Journal of Research in Personality*, *45*(6), 648ï 654. doi:10.1016/j.jrp.2011.09.002

Hong, Y., Chiu, C., Dweck, C. S., Lin, D. M. S., & Wan, W. (1999). Implicit theories, attributions, and coping: A meaning system approach. *Journal of Personality and Social Psychology*, *77*(3), 588ï 599. doi:10.1037//0022-3514.77.3.588

Horn, J. L., & Cattell, R. B. (1967). Age differences in fluid and crystallized intelligence. *Acta Psychologica*. doi:10.1016/0001-6918(67)90011-X

Intelligence. (2016). Retrieved from http://www.merriam-webster.com/dictionary/intelligence

Jackson, L., Hunter, J. E., & Hodge, C. N. (1995). Physical Attractiveness and intellectual competence: A meta-analytic review. *Social Psychology Quarterly*, *58*(2), 108ï 122.

Jardim-Botelho, A., Raff, S., De Ávila Rodrigues, R., Hoffman, H. J., Diemert, D. J., Corrêa-Oliveira, R., é Gazzinelli, M. F. (2008). Hookworm, Ascaris lumbricoides infection and polyparasitism associated with poor cognitive performance in Brazilian schoolchildren. *Tropical Medicine and International Health*, *13*(8), 994ï 1004. doi:10.1111/j.1365-3156.2008.02103.x

Jencks, C. (1972). *Inequality: A reassessment of the effect of family and schooling in America*. New York: Basic Books, Inc.

Jensen, A. R. (1978). Genetic and behavioral effects of nonrandom mating. In R. T. Osborne, C. E. Noble, & N. Weyl (Eds.), *Human Variation: The Biopsychology of Age, Race, and Sex* (pp. 51ï 105). New York: Academic Press.

Johnston, V. S., & Franklin, M. (1993). Is beauty in the eye of the beholder? *Ethology and Sociobiology*, *14*(3), 183ï 199. doi:10.1016/0162-3095(93)90005-3

Johnston, V. S., Hagel, R., Franklin, M., Fink, B., & Grammer, K. (2001). Male facial attractiveness: Evidence for hormone-mediated adaptive design. *Evolution and Human Behavior*, *22*(4), 251ï 267. doi:10.1016/S1090-5138(01)00066-6

Jokela, M., Batty, G. D., Deary, I. J., Gale, C. R., & Kivimäki, M. (2009). Low childhood IQ and early adult mortality: the role of explanatory factors in the 1958 British Birth Cohort. *Pediatrics*, *124*(3), e380ï e388. doi:10.1542/peds.2009-0334

Jones, B. C., Debruine, L. M., & Little, A. C. (2007). The role of symmetry in attraction to average faces. *Perception & Psychophysics*, *69*(8), 1273ï 1277. doi:10.3758/BF03192944

Jones, B. C., Debruine, L. M., Little, A. C., Conway, C. A., & Feinberg, D. R. (2006). Integrating gaze direction and expression in preferences for attractive faces. *Psychological Science*, *17*(7), 588ï 91. doi:10.1111/j.1467-9280.2006.01749.x

Jones, B. C., Debruine, L. M., Perrett, D. I., Little, A. C., Feinberg, D. R., & Law Smith, M. J. (2008). Effects of menstrual cycle phase on face preferences. *Archives of Sexual Behavior*, *37*(1), 78ï 84. doi:10.1007/s10508-007-9268-y

Jones, B. C., Little, A. C., Burt, D. M., & Perrett, D. I. (2004). When facial attractiveness is only skin deep. *Perception*, *33*(5), 569ï 576. doi:10.1068/p3463

Jones, B. C., Little, A. C., Feinberg, D. R., Penton-Voak, I. S., Tiddeman, B. P., & Perrett, D. I. (2004). The relationship between shape symmetry and perceived skin condition in male facial attractiveness. *Evolution and Human Behavior*, *25*(1), 24ï 30. doi:10.1016/S1090-5138(03)00080-1

Jones, D., Brace, C. L., Jankowiak, W., Laland, K. N., Lisa, E., Langlois, J. H., é Bns-goo, G. (1995). Sexual selection, physical attractiveness, and facial neoteny: Cross-cultural evidence and implications. *Current Anthropology*, *36*(5), 723ï 748.

Judd, C. M., & Park, B. (1993). Definition and assessment of accuracy in social stereotypes. *Psychological Review*, *100*(1), 109ï 128. doi:10.1037/0033-295X.100.1.109

Jussim, L. (1986). Self-fulfilling prophecies: A theoretical and integrative review. *Psychological Review*, *93*(4), 429ï 445.

Jussim, L. (1989). Teacher expectations: Self-fulfilling prophecies, perceptual biases, and accuracy. *Journal of Personality and Social Psychology*, *57*(3), 469ï 480.

Jussim, L., Eccles, J., & Madon, S. (1996). Social perception, social stereotypes, and teacher expectations: Accuracy and the quest for the powerful self-fulfilling prophecy. *Advances in Experimental Social Psychology*, *28*, 281ï 388.

doi:10.1016/S0065-2601(08)60240-3

Jussim, L., & Harber, K. D. (2005). Teacher expectations and self-fulfilling prophecies; Knowns and unknowns , resolved and unresolved controversies. *Personality and Social Psychology Review*, *9*(2), 131ï 155.

Kahneman, D., & Frederick, S. (2002). Representativeness revisited: Attribute substitution in intuitive judgment. In *Heuristics of intuitive judgment: Extensions and applications*. New York: Cambrdige University Press. doi:10.1017/CBO9780511808098.004

Kalick, S. M., Zebrowitz, L. A., Langlois, J. H., & Johnson, R. M. (1998). Does human facial attractiveness honestly advertise health? longitudinal data on an evolutionary question. *Psychological Science*, *9*(1), 8ï 13. doi:10.1111/1467-9280.00002

Kanazawa, S. (2004). Why beautiful people are more intelligent. *Intelligence*, *32*(3), 227ï 243. doi:10.1016/j.intell.2004.03.003

Kanazawa, S. (2011). Intelligence and physical attractiveness. *Intelligence*, *39*(1), 7ï 14. doi:10.1016/j.intell.2010.11.003

Kandrik, M., & DeBruine, L. M. (2012). Self-rated attractiveness predicts preferences for opposite-sex faces, while self-rated sex-typicality predicts preferences for same-sex faces. *Journal of Evolutionary Psychology*, *10*(4), 177ï 186. doi:10.1556/JEP.10.2012.4.2

Katz, D., & Braly, K. W. (1935). Racial prejudice and racial stereotypes. *The Journal of Abnormal and Social Psychology*, *30*(2), 175ï 193. doi:10.1037/h0059800

Kenealy, P., Frude, N., & Shaw, W. (2001). Influence of childrenôs physical attractiveness on teacher expectations. *The Journal of Social Psychology*, *128*(3), 373ï 383.

Kenny, D. A., Horner, C., Kashy, D. A., & Chu, L. C. (1992). Consensus at zero acquaintance: Replication , behavioral cues, and stability. *Journal of Personality and Social Psychology*, *62*(1), 88ï 97.

Kenrick, D. T. (1994). Evolutionary social psychology: From sexual selection to social cognition. *Advances in Experimental Social Psychology*, *26*(1), 75ï 121.

Kleisner, K., Chvatalova, V., & Flegr, J. (2014). Perceived intelligence is associated with measured intelligence in men but not women. *PloS One*, *9*(3), e81237. doi:10.1371/journal.pone.0081237

Kniffin, K. M., Wansink, B., Griskevicius, V., & Wilson, D. S. (2014). Beauty is in the in-group of the beholded: Intergroup differences in the perceived attractiveness of leaders. *The Leadership Quarterly*, *25*(6), 1143ï 1153. doi:10.1016/j.leaqua.2014.09.001

Kniffin, K. M., & Wilson, D. S. (2004). The effect of nonphysical traits on the perception of physical attractiveness. Three naturalistic studies. *Evolution and Human Behavior*, *25*, 88ï 101. doi:10.1016/S1090-5138(04)00006-6

Koehler, N., Simmons, L. W., Rhodes, G., & Peters, M. (2004). The relationship between sexual dimorphism in human faces and fluctuating asymmetry.

Proceedings of the Royal Society B: Biological Sciences, *271*(SUPPL. 4), S233ï S236. doi:10.1098/rsbl.2003.0146

Komori, M., Kawamura, S., & Ishihara, S. (2011). Multiple mechanisms in the perception of face gender: Effect of sex-irrelevant features. *Journal of Experimental Psychology: Human Perception and Performance*, *37*(3), 626ï 633. doi:10.1037/A0020369

Kowner, R. (1996). Facial asymmetry and attractiveness judgment in developmental perspective. *Journal of Experimental Psychology: Human Perception and Performance*, *22*(3), 662ï 675. doi:10.1037/0096-1523.22.3.662

Kramer, R. S. S., & Ward, R. (2010). Internal facial features are signals of personality and health. *Quarterly Journal of Experimental Psychology*, *63*(11), 2273ï 2287. doi:10.1080/17470211003770912

Kramer, R. S. S., & Ward, R. (2011). Different signals of personality and health from the two sides of the face. *Perception*, *40*(5), 549ï 562. doi:10.1068/p6856

Krams, I. A., Skrinda, I., Kecko, S., Moore, F. R., Krama, T., Kaasik, A., é Rantala, M. J. (2014). Body height affects the strength of immune response in young men, but not young women. *Scientific Reports*, *4*, 6223. doi:10.1038/srep06223

Kray, L. J., & Haselhuhn, M. P. (2007). Implicit negotiation beliefs and performance: experimental and longitudinal evidence. *Journal of Personality and Social Psychology*, *93*(1), 49ï 64. doi:10.1037/0022-3514.93.1.49

Lacy, R., & Sherman, P. (1983). Kin recognition by phenotype matching. *The American Naturalist*, *121*(4), 489ï 512.

Landy, D., & Sigall, H. (1974). Beauty is talent: Task evaluation as a function of the performerôs physical attractiveness. *Journal of Personality and Social Psychology*, *29*(3), 299ï 304. doi:10.1037/h0036018

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), 390ï 423. doi:10.1037//0033-2909.126.3.390

Langlois, J. H., Ritter, J. M., Casey, R. J., & Sawin, D. B. (1995). Infant attractiveness predicts maternal behaviors and attitudes. *Developmental Psychology*. doi:10.1037/0012-1649.31.3.464

Langlois, J. H., & Roggman, L. A. (1990). Attractive faces are only average. *Psychological Science*, *1*(2), 115ï 121. doi:10.1111/j.1467-9280.1990.tb00079.x

Langlois, J. H., Roggman, L. A., & Rieser-Danner, L. A. (1990). Infantsô differential social responses to attractive and unattractive faces. *Developmental Psychology*, *26*(1), 153ï 159. doi:10.1037/0012-1649.26.1.153

Lau, S. (1982). The effect of smiling on person perception. *The Journal of Social Psychology*, *117*, 63ï 67.

Law Smith, M. J., Deady, D. K., Moore, F. R., Jones, B. C., Cornwell, R. E., Stirrat, M., é Perrett, D. I. (2012). Maternal tendencies in women are associated with estrogen levels and facial femininity. *Hormones and Behavior*, *61*(1), 12ï 16.

doi:10.1016/j.yhbeh.2011.09.005

Law Smith, M. J., Perrett, D. I., Jones, B. C., Cornwell, R. E., Moore, F. R., Feinberg, D. R., é Hillier, S. G. (2006). Facial appearance is a cue to oestrogen levels in women. *Proceedings Biological Sciences*, *273*(1583), 135ï 140. doi:10.1098/rspb.2005.3296

Lefevre, C. E., Lewis, G. J., Bates, T. C., Dzhelyova, M., Coetzee, V., Deary, I. J., & Perrett, D. I. (2012). No evidence for sexual dimorphism of facial width-to-height ratio in four large adult samples. *Evolution and Human Behavior*, *33*(6), 623ï 627. doi:10.1016/j.evolhumbehav.2012.03.002

Lefevre, C. E., Lewis, G. J., Perrett, D. I., & Penke, L. (2013). Telling facial metrics: Facial width is associated with testosterone levels in men. *Evolution and Human Behavior*, *34*(4), 273ï 279. doi:10.1016/j.evolhumbehav.2013.03.005

Lewis, G. J., Lefevre, C. E., & Bates, T. C. (2012). Facial width-to-height ratio predicts achievement drive in US presidents. *Personality and Individual Differences*, *52*(7), 855ï 857. doi:10.1016/j.paid.2011.12.030

Lim, J., & Dinges, D. F. (2010). A meta-analysis of the impact of short-term sleep deprivation on cognitive variables. *Psychological Bulletin*, *136*(3), 375ï 389. doi:10.1037/a0018883

Little, A. C., Burt, D. M., Penton-Voak, I. S., & Perrett, D. I. (2001). Self-perceived attractiveness influences human female preferences for sexual dimorphism and symmetry in male faces. *Proceedings of the Royal Society B: Biological Sciences*, *268*(1462), 39ï 44. doi:10.1098/rspb.2000.1327

Little, A. C., Burt, D. M., & Perrett, D. I. (2006). What is good is beautiful: Face preference reflects desired personality. *Personality and Individual Differences*, *41*(5), 1107ï 1118. doi:10.1177/0956797615579273

Little, A. C., Cohen, D. L., Jones, B. C., & Belsky, J. (2007). Human preferences for facial masculinity change with relationship type and environmental harshness. *Behavioral Ecology and Sociobiology*, *61*(6), 967ï 973. doi:10.1007/s00265-006-0325-7

Little, A. C., DeBruine, L. M., Jones, B. C., & Waitt, C. (2008). Category contingent aftereffects for faces of different races, ages and species. *Cognition*, *106*, 1537ï 1547. doi:10.1016/j.cognition.2007.06.008

Little, A. C., & Hancock, P. J. B. (2002). The role of masculinity and distinctiveness in judgments of human male facial attractiveness. *British Journal of Psychology*, *93*(4), 451ï 464. doi:10.1348/000712602761381349

Little, A. C., & Jones, B. C. (2012). Variation in facial masculinity and symmetry preferences across the menstrual cycle is moderated by relationship context. *Psychoneuroendocrinology*, *37*(7), 999ï 1008. doi:10.1016/j.psyneuen.2011.11.007

Little, A. C., Jones, B. C., Waitt, C., Tiddeman, B. P., Feinberg, D. R., Perrett, D. I., é Marlowe, F. W. (2008). Symmetry is related to sexual dimorphism in faces: Data across culture and species. *PLoS ONE*, *3*(5), e2106. doi:10.1371/journal.pone.0002106

Little, A. C., & Perrett, D. I. (2007). Using composite images to assess accuracy in personality attribution to faces. *British Journal of Psychology*, *98*(1), 111ï 126. doi:10.1348/000712606X109648

Little, A. C., Roberts, S. C., Jones, B. C., & Burriss, R. P. (2007). The faces of leaders: Sexual dimorphism, perceived traits, and voting in context. *Evolution and Human Behavior*, *28*(1), 18ï 27.

Loehlin, J. C. (1974). *Race Differences in Intelligence.* San Fransisco: W. H. Freeman & Company.

López, S. (1999). Parasitized female guppies do not prefer showy males. *Animal Behaviour*, *57*(5), 1129ï 1134. doi:10.1006/anbe.1998.1064

Luxen, M. F., & Buunk, B. P. (2006). Human intelligence, fluctuating asymmetry and the peacockôs tail. *Personality and Individual Differences*, *41*(5), 897ï 902. doi:10.1016/j.paid.2006.03.015

Maassen, G., & Bakker, A. (2001). Suppressor variables in path models: Definitions and interpretations. *Sociological Methods & Research*, *30*(2), 241ï 270. doi:0803973233

MacKinnon, D. P., Krull, J. L., & Lockwood, C. M. (2000). Equivalence of the mediation, confounding and suppression effect. *Prevention Science*, *1*(4), 173ï 181. doi:10.1023/A1026595011371

Mackintosh, N. . (1998). *IQ and human intelligence*. Oxford: Oxford University Press.

Maisey, D. S., Vale, E. L., Cornelissen, P. L., & Tovée, M. J. (1999). Characteristics of male attractiveness for women. *The Lancet*, *353*(1), 1500.

Manning, J. T. (1995). Fluctuating asymmetry and body weight in men and women: Implications for sexual selection. *Ethology and Sociobiology*, *16*, 145ï 153. doi:10.1016/0162-3095(94)00074-H

Manning, J. T., Koukourakis, K., & Brodie, D. A. (1997). Fluctuating asymmetry, metabolic rate and sexual selection in human males. *Evolution and Human Behavior*, *18*(1), 15ï 21. doi:10.1016/S1090-5138(96)00072-4

Manning, J. T., & Pickup, L. (1998). Symmetry and performance in middle distance runners. *International Journal of Sports Medicine*, *19*(3), 205ï 209.

Manning, J. T., Scutt, D., Whitehouse, G. H., & Leinster, S. J. (1997). Breast asymmetry and phenotypic quality in women. *Evolution and Human Behavior*, *18*(4), 223ï 236. doi:10.1016/S0162-3095(97)00002-0

Manson, J., Willett, W., Stampfer, M., Colditz, G., Hunter, D. W., Hankinson, S., é Speizer, F. (1995). Body weight and mortality among women. *The New England Journal of Medicine*, *333*(11), 677ï 685.

Mare, R. D. (1991). Five decades of educational assortative mating. *American Sociological Review*, *56*(1), 15ï 32. doi:10.2307/2095670

Matts, P. J., Fink, B., Grammer, K., & Burquest, M. (2007). Color homogeneity and visual perception of age, health, and attractiveness of female facial skin. *Journal of the American Academy of Dermatology*, *57*(6), 977ï 984.

doi:10.1016/j.jaad.2007.07.040

Mavor, K. I., Macleod, C. J., Boal, M. J., & Louis, W. R. (2009). Right-wing authoritarianism, fundamentalism and prejudice revisited: Removing suppression and statistical artefact. *Personality and Individual Differences*, *46*(5-6), 592ï 597.

Mazzi, D., Künzler, R., & Bakker, T. C. M. (2003). Female preference for symmetry in computer-animated three-spined sticklebacks, Gasterosteus aculeatus. *Behavioral Ecology and Sociobiology*, *54*(2), 156ï 161. doi:10.1007/s00265-003-0609-0

McGarty, C., Yzerbyt, V. Y., & Spears, R. (2002). *Stereotypes as explanations: the formation of meaningful beliefs about social groups*. Cambridge: Cambrdige University Press. doi:10.1017/CBO9780511489877

Miller, A. G. (1970). Role of physical attractiveness in impression formation. *Psychonomic Science*, *19*(4), 241ï 243. doi:10.3758/BF03328797

Miller, D. T., & Turnbull, W. (1986). Expectancies and interpersonal processes. *Annual Review of Psychology*, *37*, 233ï 256.

Miller, G. F. (2000). Sexual selection for indicators of intelligence. In *The Nature of Intelligence* (Vol. 233, pp. 260ï 270). doi:10.1002/0470870850.ch16

Miller, G. F., & Todd, P. M. (1998). Mate choice turns cognitive. *Trends in Cognitive Sciences*, *2*(5), 190ï 198. doi:10.1016/S1364-6613(98)01169-3

Mitchem, D. G., Zietsch, B. P., Wright, M. J., Martin, N. G., Hewitt, J. K., & Keller, M. C. (2014). No relationship between intelligence and facial attractiveness in a large, genetically informative sample. *Evolution and Human Behavior*, *36*(3), 240ï 247. doi:10.1016/j.evolhumbehav.2014.11.009

Mokdad, A. H., Ford, E. S., Bowman, B. A., Dietz, W. H., Vinicor, F., Bales, V. S., & Marks, J. S. (2003). Prevalence of obesity, diabetes, and obesity-related health risk factors, 2001. *Journal of the American Medical Association*, *289*(1), 76ï 9. doi:10.1001/jama.289.1.76.

Möller, A. P., & Alatalo, R. V. (1999). Good-genes effects in sexual selection. *Proceedings of the Royal Society B: Biological Sciences*, *266*, 85ï 91. doi:10.1098/rspb.1999.0607

Monin, B., & Oppenheimer, D. M. (2005). Correlated averages vs. averaged correlations: Demonstrating the warm glow heuristic beyond aggregation. *Social Cognition*, *23*(3), 257ï 278. doi:10.1521/soco.2005.23.3.257

Moore, F. R., Filippou, D., & Perrett, D. I. (2011). Intelligence and attractiveness in the face: Beyond the attractiveness halo effect. *Journal of Evolutionary Psychology*, *9*(3), 205ï 217. doi:10.1556/JEP.9.2011.3.2

Moutafi, J., Furnham, A., & Crump, J. (2003). Demographic and personality predictors of intelligence: A study using the neo personality inventory and the myers-briggs type indicator. *European Journal of Personality*, *17*(1), 79ï 94. doi:10.1002/per.471

Moutafi, J., Furnham, A., & Paltiel, L. (2004). Why is conscientiousness negatively correlated with intelligence? *Personality and Individual Differences*, *37*(5), 1013ï

1022. doi:10.1016/j.paid.2003.11.010

Mueller, U., & Mazur, A. (1996). Facial dominance of West Point cadets as a predictor of later military rank. *Social Forces*, *74*(3), 823ï 850. doi:10.2307/2580383

Munshi, M., Grande, L., Hayes, M., Ayres, D., Suhl, E., Capelson, R., é Katie Weinger, E. (2006). Cognitive dysfunction is associated with poor diabetes control in older adults. *Diabetes Care*, *29*(8), 1794ï 1799. doi:10.2337/dc06-0506

Murphy, M., Nelson, D., & Cheap, T. (1981). Rated and actual performance of high school students as a function of sex and attractiveness. *Psychological Reports*, *48*(1), 103ï 106. doi:10.2466/pr0.1981.48.1.103

Murstein, B. (1970). Stimulus-value-role: A theory of marital choice. *Journal of Marriage and Family*, *32*(3), 465ï 481.

Must, A., Spadano, J., Coakley, E. H., Field, a E., Colditz, G., & Dietz, W. H. (1999). The disease burden associated with overweight and obesity. *JAMA: The Journal of the American Medical Association*, *282*(16), 1523ï 1529. doi:10.1001/jama.282.16.1523

Neisser, U., Boodoo, G., Bouchard, Thomas J., J., Boykin, A. W., Brody, N., Ceci, S. J., é Urbina, S. (1996). Intelligence: Knowns and unknowns. *American Psychologist*, *51*(2), 77ï 101. doi:10.1037//0003-066X.51.2.77

Nunnally, J. (1978). *Psychometric methods*. New York: McGraw-Hill.

OôDoherty, J., Winston, J., Critchley, H., Perrett, D. I., Burt, D. M., & Dolan, R. J. (2003). Beauty in a smile: the role of medial orbitofrontal cortex in facial attractiveness. *Neuropsychologia*, *41*(2), 147ï 55.

Oginska, H., & Pokorski, J. (2006). Fatigue and mood correlates of sleep length in three age-social groups: School children, students, and employees. *Chronobiology Iternational*, *23*(6), 1317ï 1328. doi:10.1080/07420520601089349

Ohayon, M. M., & Vecchierini, M. F. (2005). Normative sleep data, cognitive function and daily living activities in older adults in the community. *Sleep*, *28*(8), 981ï 989.

Okereke, O. I., & Grodstein, F. (2013). Phobic anxiety and cognitive performance over 4 years among community-dwelling older women in the nursesö health study. *American Journal of Geriatric Psychiatry*, *21*(11), 1125ï 1134. doi:10.1097/JGP.0b013e318267018c

Olivola, C. Y., Eubanks, D. L., & Lovelace, J. B. (2014). The many (distinctive) faces of leadership: Inferring leadership domain from facial appearance. *Leadership Quarterly*, *25*(5), 817ï 834. doi:10.1016/j.leaqua.2014.06.002

Olivola, C. Y., Sussman, A. B., Tsetsos, K., Kang, O. E., & Todorov, A. T. (2012). Republicans prefer republican-looking leaders: Political facial stereotypes predict candidate electoral success among right-leaning voters. *Social Psychological and Personality Science*, *3*(5), 605ï 613. doi:10.1177/1948550611432770

Olivola, C. Y., & Todorov, A. T. (2010). Fooled by first impressions? Reexamining the diagnostic value of appearance-based inferences. *Journal of Experimental Social Psychology*, *46*(2), 315ï 324. doi:10.1016/j.jesp.2009.12.002

Omaye, S. (1993). Nutrient deficiencies and pregnancy outcome. *Dietary Factors and Birth Defects*.

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

Osborne, J. (2003). Effect sizes and the disattenuation of correlation and regression coefficients: lessons from educational psychology. *Practical Assessment, Research and Evaluation*, *8*(11).

Owens, G., & Ford, J. G. (1978). Further consideration of the ñWhat is good is beautifulò finding. *Social Psychology*, *41*(1), 73ï 75.

Özener, B. (2012). Facial width-to-height ratio in a Turkish population is not sexually dimorphic and is unrelated to aggressive behavior. *Evolution and Human Behavior*, *33*(3), 169ï 173. doi:10.1016/j.evolhumbehav.2011.08.001

Palmer, A. R., & Strobecke, C. (2015). Fluctuating asymmetry: Measurement, analysis, patterns. *Annual Review of Ecology and Systematics*, *17*(1986), 391ï 421.

Park, J. H., & Schaller, M. (2005). Does attitude similarity serve as a heuristic cue for kinship? Evidence of an implicit cognitive association. *Evolution and Human Behavior*, *26*(2), 158ï 170. doi:10.1016/j.evolhumbehav.2004.08.013

Park, J. H., Schaller, M., & Van Vugt, M. (2008). Psychology of human kin recognition: Heuristic cues, erroneous inferences, and their implications. *Review of General Psychology*, *12*(3), 215ï 235. doi:10.1037/1089-2680.12.3.215

Parkinson, K. N., Tovée, M. J., & Cohen-Tovee, E. M. (1998). Body shape perceptions of preadolescent and young adolescent children. *European Eating Disorders Review*, *135*(6), 126ï 136.

Pascalis, O., de Schonen, S., Morton, J., Deruelle, C., & Fabre-Grenet, M. (1995). Motherôs face recognition by neonates: A replication and an extension. *Infant Behavior and Development*, *18*(1), 79ï 85. doi:10.1016/0163-6383(95)90009-8

Paulhus, D. L. (1998). Self-report measures of intelligence: Are they useful as proxy IQ tests? *Journal of Personality*, *66*(4), 525ï 554. doi:10.1111/1467-6494.00023

Pawğowski, B., & Dunbar, R. I. (1999). Impact of market value on human mate choice decisions. *Proceedings of the Royal Society of London*, *266*, 281ï 285. doi:10.1098/rspb.1999.0634

Penke, L., Bates, T. C., Gow, A. J., Pattie, A., Starr, J. M., Jones, B. C., é Deary, I. J. (2009). Symmetric faces are a sign of successful cognitive aging. *Evolution and Human Behavior*, *30*(6), 429ï 437. doi:10.1016/j.evolhumbehav.2009.06.001

Penton-Voak, I. S., & Chen, J. Y. (2004). High salivary testosterone is linked to masculine male facial appearance in humans. *Evolution and Human Behavior*, *25*(4), 229ï 241. doi:10.1016/j.evolhumbehav.2004.04.003

Penton-Voak, I. S., Jacobson, A., & Trivers, R. L. (2004). Populational differences in attractiveness judgements of male and female faces: Comparing British and Jamaican samples. *Evolution and Human Behavior*, *25*, 355ï 370.

doi:10.1016/j.evolhumbehav.2004.06.002

Penton-Voak, I. S., Jones, B. C., Little, A. C., Baker, S., Tiddeman, B. P., Burt, D. M., & Perrett, D. I. (2001). Symmetry, sexual dimorphism in facial proportions and male facial attractiveness. *Proceedings Biological Sciences*, *268*(1476), 1617ï 1623. doi:10.1098/rspb.2001.1703

Penton-Voak, I. S., & Perrett, D. I. (2000). Female preference for male faces changes cyclically: Further evidence. *Evolution and Human Behavior*, *21*, 39ï 48.

Penton-Voak, I. S., Perrett, D. I., Castles, D. L., Kobayashi, T., Burt, D. M., Murray, L. K., & Minamisawa, R. (1999). Menstrual cycle alters face preference. *Nature*, *399*(6738), 741ï 742. doi:10.1038/21557

Penton-Voak, I. S., Pound, N., Little, A. C., & Perrett, D. I. (2006). Personality judgments from natural and composite facial images: More evidence for a ñkernel of truthò in social perception. *Social Cognition*, *24*(5), 607ï 640. doi:10.1521/soco.2006.24.5.607

Perkinson-gloor, N., Arx, P. H., Brand, S., Holsboer-Trachsler, E., Grob, A., Weber, P., & Lemola, S. (2015). The role of sleep and the hypothalamic-pituitary-adrenal axis for behavioral and emotional problems in very preterm children during middle childhood. *Journal of Psychiatric Research*, *60*, 141ï 147. doi:10.1016/j.jpsychires.2014.10.005

Perkinson-Gloor, N., Lemola, S., & Grob, A. (2013). Sleep duration, positive attitude toward life, and academic achievement: The role of daytime tiredness, behavioral persistence, and school start times. *Journal of Adolescence*, *36*(2), 311ï 318. doi:10.1016/j.adolescence.2012.11.008

Perrett, D. I. (2010). *In your face: The new science of human attraction*. Palgrave Macmillan.

Perrett, D. I., Burt, D. M., Penton-Voak, I. S., Lee, K. J., Rowland, D. A., & Edwards, R. (1999). Symmetry and human facial attractiveness. *Evolution and Human Behavior*, *20*(5), 295ï 307. doi:10.1016/S1090-5138(99)00014-8

Perrett, D. I., Lee, K. J., Penton-Voak, I. S., Rowland, D. A., Yoshikawa, S., Burt, D. M., é Akamatsu, S. (1998). Effects of sexual dimorphism on facial attractiveness. *Nature*, *394*(6696), 884ï 887.

Perrett, D. I., May, K. A., & Yoshikawa, S. (1994). Facial shape and judgements of female attractiveness. *Nature*, *368*(6468), 239ï 242. doi:10.1038/368239a0

Pilcher, J. J., & Huffcutt, A. J. (1996). Effects of sleep deprivation on performance: A meta-analysis. *Sleep: Journal of Sleep Research & Sleep Medicine*, *19*(4), 318ï 326.

Pi-Sunyer, X. (1993). Medical hazards of obesity. *Annals of Internal Medicine*, *119*(7), 655ï 660.

Plomin, R., & Spinath, F. M. (2004). Intelligence: genetics, genes, and genomics. *Journal of Personality and Social Psychology*, *86*(1), 112ï 29. doi:10.1037/0022-3514.86.1.112

Ponsonby, A., Dwyer, T., & Couper, D. (1997). Sleeping position, infant apnea, and cyanosis: a population-based study. *Pediatrics*, *99*(1), 31ï 37.

Pound, N., Lawson, D. W., Toma, A. M., Richmond, S., Zhurov, A. I., Ian, S., & Penton-Voak, I. S. (2014). Facial fluctuating asymmetry is not associated with childhood ill-health in a large British cohort study Facial fluctuating asymmetry is not associated with childhood ill-health in a large British cohort study.

Pound, N., Penton-Voak, I. S., & Surridge, A. K. (2009). Testosterone responses to competition in men are related to facial masculinity. *Proceedings Royal Society of London B*, *276*(1654), 153ï 159. doi:10.1098/rspb.2008.0990

Price, R., & Vandenberg, S. (1980). Spouse similarity in American and Swedish couples. *Behavior Genetics*, *10*(1), 59ï 71.

Prokosch, M. D., Coss, R. G., Scheib, J. E., & Blozis, S. a. (2009). Intelligence and mate choice: intelligent men are always appealing. *Evolution and Human Behavior*, *30*(1), 11ï 20. doi:10.1016/j.evolhumbehav.2008.07.004

Prokosch, M. D., Yeo, R. A., & Miller, G. F. (2005). Intelligence tests with higher g-loadings show higher correlations with body symmetry: Evidence for a general fitness factor mediated by developmental stability. *Intelligence*, *33*(2), 203ï 213. doi:10.1016/j.intell.2004.07.007

Quist, M. C., DeBruine, L. M., Little, A. C., & Jones, B. C. (2012). Integrating social knowledge and physical cues when judging the attractiveness of potential mates. *Journal of Experimental Social Psychology*, *48*(3), 770ï 773. doi:10.1016/j.jesp.2011.12.018

Rantala, M. J., Coetzee, V., Moore, F. R., Skrinda, I., Kecko, S., Krama, T., é Krams, I. A. (2013). Adiposity, compared with masculinity, serves as a more valid cue to immunocompetence in human mate choice. *Proceedings Royal Society of London B*, *280*(1751), 20122495. doi:10.1098/rspb.2012.2495

Raudenbush, S. W. (1984). Magnitude of teacher expectancy effects on pupil IQ as a function of the credibility of expectancy induction: A synthesis of findings from 18 experiments. *Journal of Educational Psychology*, *76*(1), 85ï 97.

Re, D. E., & Perrett, D. I. (2012). Concordant preferences for actual height and facial cues to height. *Personality and Individual Differences*, *53*(7), 901ï 906. doi:10.1016/j.paid.2012.07.001

Regan, P. (1998). What if you canôt get what you want? Willingness to compromise ideal mate selection standards as a function of sex, mate value, and relationship context. *Personality and Social Psychology Bulletin*, *24*(12), 1294ï 1303.

Reynolds, C. A., Baker, L. A., & Pedersen, N. L. (2000). Multivariate models of mixed assortment: Phenotypic assortment and social homogamy for education and fluid ability. *Behavior Genetics*, *30*(6), 455ï 476. doi:10.1023/A:1010250818089

Rhodes, G. (2006). The evolutionary psychology of facial beauty. *Annual Review of Psychology*, *57*, 199ï 226. doi:10.1146/annurev.psych.57.102904.190208

Rhodes, G., Chan, J., Zebrowitz, L. A., & Simmons, L. W. (2003). Does sexual dimorphism in human faces signal health? *Proceedings Royal Society of London B*, *270*, S93ï S95. doi:10.1098/rsbl.2003.0023

Rhodes, G., Simmons, L. W., & Peters, M. (2005). Attractiveness and sexual behavior: Does attractiveness enhance mating success? *Evolution and Human Behavior*, *26*(2), 186ï 201. doi:10.1016/j.evolhumbehav.2004.08.014

Rhodes, G., Sumich, A., & Byatt, G. (1999). Are average facial configurations attractive only because of their symmetry? *Psychological Science*, *10*(1), 52ï 58. doi:10.1111/1467-9280.00106

Rhodes, G., Yoshikawa, S., Palermo, R., Simmons, L. W., Peters, M., Lee, K., é Crawford, J. R. (2007). Perceived health contributes to the attractiveness of facial symmetry, averageness, and sexual dimorphism. *Perception*, *36*(8), 1244ï 1252. doi:10.1068/p5712

Rhodes, G., Zebrowitz, L. A., Clark, A., Kalick, S. M., Hightower, A., & Mckay, R. (2001). Do facial averageness and symmetry signal health? *Evolution and Human Behavior*, *22*, 31ï 46. doi:10.1016/S1090-5138(00)00060-X

Richeson, J. A., & Shelton, J. N. (2003). When prejudice does not pay: Effect of interracial contact on executive function. *Psychological Science*, *14*(3), 287ï 290.

Richeson, J. A., & Trawalter, S. (2005). Why do interracial interactions impair executive function? A resource depletion account. *Journal of Personality and Social Psychology*, *88*(6), 934ï 947. doi:10.1037/0022-3514.88.6.934

Ritts, V., Patterson, M. L., & Tubbs, M. E. (1992). Expectations, impressions, and judgments of physically attractive students: A review. *Review of Educational Research*, *62*(4), 413ï 426.

Ritz, B. W., & Gardner, E. M. (2006). Malnutrition and energy restriction differentially affect viral immunity. *The Journal of Nutrition*, *136*(5), 1141ï 1144.

Roberts, B. W., Lejuez, C. W., Krueger, R. F., Richards, J. M., & Hill, P. L. (2014). What is conscientiousness and how can it be assessed? *Developmental Psychology*, *50*(5), 1315ï 30. doi:10.1037/a0031109

Roberts, M. L., Buchanan, K. L., & Evans, M. R. (2004). Testing the immunocompetence handicap hypothesis: A review of the evidence. *Animal Behaviour*, *68*(2), 227ï 239. doi:10.1016/j.anbehav.2004.05.001

Robins, A. (1991). *Biology of the pigment cell. Biological Perspectives on Human Pigmentation*. New York: Cambridge University Press.

Roney, J. R., Hanson, K. N., Durante, K. M., & Maestripieri, D. (2006). Reading menôs faces: women's mate attractiveness judgments track men's testosterone and interest in infants. *Proceedings of the Royal Society B: Biological Sciences*, *273*(1598), 2169ï 2175. doi:10.1098/rspb.2006.3569

Rosenthal, R., & Jacobson, L. F. (1968). Teacher expectations for the disadvantaged. *Scientific American*. doi:10.1038/scientificamerican0468-19

Rule, N. O., & Ambady, N. (2008). The Face of Success: inferences from chief executive officersô appearance predict company profits. *Psychological Science*, *19*(2), 109ï 111. doi:10.1111/j.1467-9280.2008.02054.x

Rule, N. O., & Ambady, N. (2009). Sheôs got the look: Inferences from female chief executive officers' faces predict their success. *Sex Roles*, *61*(9-10), 644ï 652. doi:10.1007/s11199-009-9658-9

Rule, N. O., & Ambady, N. (2010). First impressions of the face: Predicting success. *Social and Personality Psychology Compass*, *8*(4), 506ï 516. doi:10.1111/j.1751-9004.2010.00282.x

Rushton, J. P., & Jensen, A. R. (2005). Thirty years of research on race differences in cognitive ability. *Psychology, Public Policy, and Law*, *11*(2), 235ï 294. doi:10.1037/1076-8971.11.2.235

Rushton, J. P., Littlefield, C. H., & Lumsden, C. J. (1986). Gene-culture coevolution of complex social behavior: human altruism and mate choice. *Proceedings of the National Academy of Sciences of the United States of America*, *83*(October), 7340ï 7343. doi:10.1073/pnas.83.19.7340

Rushton, J. P., & Nicholson, I. R. (1988). Genetic similarity theory, intelligence, and human mate choice. *Ethology and Sociobiology*, *9*(1), 45ï 58.

Said, C. P., Baron, S. G., & Todorov, A. T. (2009). Nonlinear amygdala response to face trustworthiness: contributions of high and low spatial frequency information. *Journal of Cognitive Neuroscience*, *21*(3), 519ï 528. doi:10.1162/jocn.2009.21041

Salvia, J., Algozzine, R., & Sheare, J. (1977). Attractiveness and school achievement. *Journal of School Psychology*, *15*(1), 60ï 67. doi:10.1016/0022-4405(77)90062-0

Samuels, C. A., Butterworth, G., Roberts, T., Graupner, L., & Hole, G. (1994). Facial aesthetics: Babies prefer attractiveness to symmetry. *Perception*, *23*, 823ï 831. doi:10.1068/p230823n

Sanders, W. B., Osborne, R. T., & Greene, J. E. (1955). Intelligence and academic performance of college students of urban, rural, and mixed backgrounds. *The Journal of Educational Research*, *49*(3), 185ï 193.

Scheib, J. E., Gangestad, S. W., & Thornhill, R. (1999). Facial attractiveness, symmetry and cues of good genes. *Proceedings Biological Sciences*, *266*(1431), 1913ï 1917. doi:10.1098/rspb.1999.0866

Scott, I. M. L., Clark, A. P., Boothroyd, L. G., & Penton-Voak, I. S. (2013). Do menôs faces really signal heritable immunocompetence? *Behavioral Ecology : Official Journal of the International Society for Behavioral Ecology*, *24*(3), 579ï 589. doi:10.1093/beheco/ars092

Scott, I. M. L., Swami, V., Josephson, S. C., & Penton-Voak, I. S. (2008). Context-dependent preferences for facial dimorphism in a rural Malaysian population. *Evolution and Human Behavior*, *29*(4), 289ï 296. doi:10.1016/j.evolhumbehav.2008.02.004

Sell, A., Cosmides, L., Tooby, J., Sznycer, D., von Rueden, C., & Gurven, M. (2009). Human adaptations for the visual assessment of strength and fighting ability from the body and face. *Proceedings Royal Society of London B*, *276*(1656), 575ï 584. doi:10.1098/rspb.2008.1177

Short, L. A., Mondloch, C. J., McCormick, C. M., Carré, J. M., Ma, R., Fu, G., & Lee,

K. (2012). Detection of propensity for aggression based on facial structure irrespective of face race. *Evolution and Human Behavior*, *33*(2), 121ï 129. doi:10.1016/j.evolhumbehav.2011.07.002

Sim, T., Simon, S. L., Domier, C. P., Richardson, K., & Rawson, R. A. (2001). Cognitive deficits among methamphetamine users with attention deficit hyperactivity disorder symptomatology cognitive deficits among methamphetamine users with attention deficit hyperactivity disorder symptomatology. *Substance Abuse*, *21*(1), 61ï 74. doi:10.1300/J069v21n01

Singer, J. E. (1964). The Use of manipulative strategies; Machiavellianism and attractiveness. *Sociometry*, *27*(2), 128ï 150.

Singh, D. (1995). Female health, attractiveness, and desirability for relationships: Role of breast asymmetry and waist-to-hip ratio. *Ethology and Sociobiology*, *16*(6), 465ï 481. doi:10.1016/0162-3095(95)00073-9

Slater, A., Bremner, G., Johnson, S., Sherwood, P., Hayes, R. A., & Brown, E. (2000). Newborn infantsô preference for attractive faces: the role of internal and external facial features. *Infancy*, *1*(2), 265ï 274. doi:10.1207/S15327078IN0102_8

Slater, A., Von der Schulenburg, C., Brown, E., Badenoch, M., Butterworth, G., Parsons, S., & Samuels, C. A. (1998). Newborn infants prefer attractive faces. *Infant Behavior and Development*, *21*(2), 345ï 354. doi:10.1016/S0163-6383(98)90011-X

Smith, F. G., Jones, B. C., Debruine, L. M., & Little, A. C. (2009). Interactions between masculinity-femininity and apparent health in face preferences. *Behavioral Ecology*, *20*(November), 441ï 445. doi:10.1093/beheco/arn141

Sorhagen, N. S. (2013). Early teacher expectations disproportionately affect poor childrenôs high school performance. *Journal of Educational Psychology*, *105*(2), 465ï 477. doi:10.1037/a0031754

Sparacino, J., & Hansell, S. (1979). Physical attractiveness and academic performance: Beauty is not always talent. *Journal of Personality*, *47*(3), 449ï 469.

Spearman, C. (1905). General intelligence, objectively determined and measured. *Psychological Bulletin*, *15*(2), 201ï 292. doi:10.1037/h0065005

Spearman, C. (1927). *The abilities of man.* Oxford: Macmillan.

Stamatas, G. N., Zmudzka, B. Z., Kollias, N., & Beer, J. Z. (2004). Non-invasive measurements of skin pigmentation in situ. *Pigment Cell Research*, *17*(October), 618ï 626. doi:10.1111/j.1600-0749.2004.00204.x

Stanovich, K. E., & West, R. F. (2008). On the relative independence of thinking biases and cognitive ability. *Journal of Personality and Social Psychology*, *94*(4), 672ï 695. doi:10.1037/0022-3514.94.4.672

Steiger, J. H. (1980). Tests for comparing elements of a correlation matrix. *Psychological Bulletin*. doi:10.1037/0033-2909.87.2.245

Stephen, I. D., Coetzee, V., Law Smith, M. J., & Perrett, D. I. (2009). Skin blood perfusion and oxygenation colour affect perceived human health. *PLoS ONE*, *4*(4), e5083. doi:10.1371/journal.pone.0005083

Stephen, I. D., Coetzee, V., & Perrett, D. I. (2011). Carotenoid and melanin pigment coloration affect perceived human health. *Evolution and Human Behavior*, *32*(3), 216ï 227. doi:10.1016/j.evolhumbehav.2010.09.003

Stephen, I. D., Law Smith, M. J., Stirrat, M. R., & Perrett, D. I. (2009). Facial skin coloration affects perceived health of human faces. *International Journal of Primatology*, *30*(6), 845ï 857. doi:10.1007/s10764-009-9380-z

Stephen, I. D., Scott, I. M. L., Coetzee, V., Pound, N., Perrett, D. I., & Penton-Voak, I. S. (2012). Cross-cultural effects of color, but not morphological masculinity, on perceived attractiveness of menôs faces. *Evolution and Human Behavior*, *33*(4), 260ï 267. doi:10.1016/j.evolhumbehav.2011.10.003

Sternberg, R. J. (1985). *Beyond IQ: A Triarchic Theory of Human Intelligence*. New York: Cambrdige University Press.

Sternberg, R. J. (2000). *Handbook of Intelligence*. New York: Cambridge University Press.

Stirrat, M. R., & Perrett, D. I. (2010). Valid facial cues to cooperation and trust: Male facial width and trustworthiness. *Psychological Science*, *21*(3), 349ï 354. doi:10.1177/0956797610362647

Sundelin, T., Lekander, M., Kecklund, G., Van Someren, E. J. W., Olsson, A., & Axelsson, J. (2013). Cues of fatigue: effects of sleep deprivation on facial appearance. *Sleep*, *36*(9), 1355ï 1360. doi:10.5665/sleep.2964

Sutherland, C. A. M., Oldmeadow, J. A., Santos, I. M., Towler, J., Burt, D. M., & Young, A. W. (2013). Social inferences from faces: Ambient images generate a three-dimensional model. *Cognition*, *127*(1), 105ï 118. doi:10.1016/j.cognition.2012.12.001

Swami, V., Knight, D., Tovée, M. J., Davies, P., & Furnham, A. (2007). Preferences for female body size in Britain and the South Pacific. *Body Image*, *4*(2), 219ï 23. doi:10.1016/j.bodyim.2007.01.002

Swami, V., & Tovée, M. J. (2005). Male physical attractiveness in Britain and Malaysia: A cross-cultural study. *Body Image*, *2*(4), 383ï 93. doi:10.1016/j.bodyim.2005.08.001

Symons, D. (1995). Beauty is in the adaptations of the beholder: The evolutionary psychology of human female sexual attractiveness. In *Sexual Nature, Sexual Culture* (pp. 80ï 118).

Taylor, W. S. (1923). Rationalization and its social significance. *The Journal of Abnormal Psychology and Social Psychology*, *17*(4), 410ï 418. doi:10.1037/h0069451

Thomas, M., Sing, H., Belenky, G., Holcomb, H., Mayberg, H., Dannals, R., é Redmond, D. (2000). Neural basis of alertness and cognitive performance impairments during sleepiness: Effects of 24h of sleep deprivation on waking human regional brain activity. *Journal of Sleep Research*, *9*(4), 105ï 118.

Thorndike, E. (1920). A constant error in psychological ratings. *Journal of Applied Psychology*, *4*(1), 25ï 29.

Thornhill, R., & Gangestad, S. W. (1993). Human facial beauty: Averageness, symmetry, and parasite resistance. *Human Nature*, *4*(3), 237ï 269.

Thornhill, R., & Gangestad, S. W. (1996). The evolution of human sexuality. *Trends in Ecology & Evolution*, *11*(2), 98ï 102. doi:10.1016/0169-5347(96)81051-2

Thornhill, R., & Gangestad, S. W. (1999). Facial attractiveness. *Trends in Cognitive Sciences*, *3*(12), 452ï 460. doi:10.1016/S1364-6613(99)01403-5

Thornhill, R., & Gangestad, S. W. (2006). Facial sexual dimorphism, developmental stability, and susceptibility to disease in men and women. *Evolution and Human Behavior*, *27*(2), 131ï 144. doi:10.1016/j.evolhumbehav.2005.06.001

Thornhill, R., & Grammer, K. (1999). The body and face of woman. *Evolution and Human Behavior*, *20*(2), 105ï 120. doi:10.1016/S1090-5138(98)00044-0

Tiddeman, B. P., Burt, D. M., & Perrett, D. I. (2001). Prototyping and transforming facial textures for perception research. *Computer Graphics and Applications*, *21*(5), 42ï 50.

Tinlin, R. M., Watkins, C. D., Welling, L. L. M., Debruine, L. M., Al-Dujaili, E. a S., & Jones, B. C. (2013). Perceived facial adiposity conveys information about womenôs health. *British Journal of Psychology*, *104*(2), 235ï 248. doi:10.1111/j.2044-8295.2012.02117.x

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

Todorov, A. T., Olivola, C. Y., Dotsch, R., & Mende-Siedlecki, P. (2015). Social attributions from faces: Determinants, consequences, accuracy, and functional significance. *Annual Review of Psychology*, *66*(15), 1ï 27. doi:10.1146/annurev-psych-113011-143831

Todorov, A. T., & Porter, J. M. (2014). Misleading first impressions: Different for different facial images of the same person. *Psychological Science*, *25*(7), 1404ï 1417. doi:10.1177/0956797614532474

Todorov, A. T., Said, C. P., Engell, A. D., & Oosterhof, N. N. (2008). Understanding evaluation of faces on social dimensions. *Trends in Cognitive Sciences*, *12*(12), 455ï 460. doi:10.1016/j.tics.2008.10.001

Tognetti, A., Berticat, C., Raymond, M., & Faurie, C. (2014). Assortative mating based on cooperativeness and generosity. *Journal of Evolutionary Biology*, *27*(5), 975ï 981. doi:10.1111/jeb.12346

Tovée, M. J., Reinhardt, S., Emery, J. L., & Cornelissen, P. L. (1998). Optimum body-mass index and maximum sexual attractiveness. *Lancet*, *352*(October), 548. doi:10.1016/S0140-6736(05)79257-6

Tovée, M. J., Swami, V., Furnham, A., & Mangalparsad, R. (2006). Changing perceptions of attractiveness as observers are exposed to a different culture.

Evolution and Human Behavior, *27*(6), 443ï 456. doi:10.1016/j.evolhumbehav.2006.05.004

Tversky, A., & Kahneman, D. (1974). Judgement under uncertainty: Heuristics and biases. *Science*, *185*(4157), 1124ï 1131.

Tzelgov, J., & Henik, A. (1991). Suppression situations in psychological research: Definitions, implications, and applications. *Psychological Bulletin*, *109*(3), 524ï 536. doi:10.1037/0033-2909.109.3.524

Vandenberg, S. (1972). Assortative mating, or who marries whom? *Behavior Genetics*, *2*(2-3), 127ï 157.

von Schantz, T., Bensch, S., Grahn, M., Hasselquist, D., & Wittzell, H. (1999). Good genes, oxidative stress and condition-dependent sexual signals. *Proceedings of the Royal Society B: Biological Sciences*, *266*(1414), 1ï 12. doi:10.1098/rspb.1999.0597

Vukovic, J., Jones, B. C., Debruine, L. M., Feinberg, D. R., Smith, F. G., Little, A. C., é Main, J. (2010). Womenõs own voice pitch predicts their preferences for masculinity in men's voices. *Behavioral Ecology*, *21*(4), 767ï 772. doi:10.1093/beheco/arq051

Walker, M. P. (2009). The role of sleep in cognition and emotion. *Annals of the New York Academy of Sciences*, *1156*, 168ï 197. doi:10.1111/j.1749-6632.2009.04416.x

Walton, D. (1999). Rethinking the fallacy of hasty generalization. *Argumentation*, (1), 161ï 182.

Watkins, M., & Meredith, W. (1981). Spouse similarity in newlyweds with respect to specific cognitive abilities, socioeconomic status, and education. *Behavior Genetics*, *11*(1), 1ï 21.

Waynforth, D., Delwadia, S., & Camm, M. (2005). The influence of womenõs mating strategies on preference for masculine facial architecture. *Evolution and Human Behavior*, *26*(5), 409ï 416. doi:10.1016/j.evolhumbehav.2005.03.003

Weston, E. M., Friday, A. E., & Liò, P. (2007). Biometric evidence that sexual selection has shaped the hominin face. *PLoS ONE*, *2*(8), e710. doi:10.1371/journal.pone.0000710

Wickens, C. D., Hutchins, S. D., Laux, L., & Sebok, a. (2015). The Impact of Sleep Disruption on Complex Cognitive Tasks: A Meta-Analysis. *Human Factors: The Journal of the Human Factors and Ergonomics Society*. doi:10.1177/0018720815571935

Wilson, J. M., & Manning, J. T. (1996). Fluctuating asymmetry and age in children: Evolutionary implications for the control of developmental stability. *Journal of Human Evolution*, *30*(6), 529ï 537.

Wilson, P. W. F., DõAgostino, R. B., Sullivan, L., Parise, H., & Kannel, W. B. (2002). Overweight and obesity as determinants of cardiovascular risk: the Framingham experience. *Archives of Internal Medicine*, *162*(16), 1867ï 1872. doi:10.1001/archinte.162.16.1867

Windhager, S., Schaefer, K., & Fink, B. (2011). Geometric morphometrics of male facial shape in relation to physical strength and perceived attractiveness, dominance, and masculinity. *American Journal of Human Biology*, *23*(6), 805ï 814. doi:10.1002/ajhb.21219

Wood, P., & Englert, P. (2009). Intelligence compensation theory: A critical examination of the negative relationship between conscientiousness and fluid and crystallised intelligence. *The Australian and New Zealand Journal of Organisational Psychology*, *2*, 19ï 29. doi:10.1375/ajop.2.1.19

Yassuda, M. S., Lopes, A., Cachioni, M., Falcao, D. V. S., Batistoni, S. S. T., Guimaraes, V. V., & Neri, A. L. (2012). Frailty criteria and cognitive performance are related: Data from the Fibra study in Ermelino Matarazzo, Sao Paulo, Brazil. *Journal of Nutrition, Health and Aging*, *16*(1), 55ï 61. doi:10.1007/s12603-012-0003-6

Zebrowitz, L. A. (2004). The origin of first impressions. *Journal of Cultural and Evolutionary Psychology*, *2*(1-2), 93ï 108.

Zebrowitz, L. A., Bronstad, M., & Lee, H. K. (2007). The contribution of face familiarity to ingroup favoritism and stereotyping. *Social Cognition*, *25*(2), 306ï 338.

Zebrowitz, L. A., Fellous, J. M., Mignault, A., & Andreoletti, C. (2003). Trait impressions as overgeneralized responses to adaptively significant facial qualities: evidence from connectionist modeling. *Personality and Social Psychology Review*, *7*(3), 194ï 215. doi:10.1207/S15327957PSPR0703_01

Zebrowitz, L. A., Hall, J. A., Murphy, N. A., & Rhodes, G. (2002). Looking smart and looking good: Facial cues to intelligence and their origins. *Personality and Social Psychology Bulletin*, *28*(2), 238ï 249. doi:10.1177/0146167202282009

Zebrowitz, L. A., Kendall-Tackett, K., & Fafel, J. (1991). The influence of childrenõs facial maturity on parental expectations and punishments. *Journal of Experimental Child Psychology*, *52*(2), 221ï 238. doi:10.1016/0022-0965(91)90060-6

Zebrowitz, L. A., Kikuchi, M., & Fellous, J. M. (2010). Facial resemblance to emotions: group differences, impression effects, and race stereotypes. *Journal of Personality and Social Psychology*, *98*(2), 175ï 189. doi:10.1037/a0017990

Zebrowitz, L. A., & McDonald, S. M. (1991). The impact of litigantsô baby-facedness and attractiveness on adjudications in small claims courts. *Law and Human Behavior*, *15*(6), 603ï 623. doi:10.1007/BF01065855

Zebrowitz, L. A., & Montepare, J. M. (1992). Impressions of babyfaced individuals across the life span. *Developmental Psychology*, *28*(6), 1143ï 1152.

Zebrowitz, L. A., & Rhodes, G. (2004). Sensitivity to ñbad genesò and the anomalous face overgeneralization effect: Cue validity, cue utilization, and accuracy in judging intelligence and health. *Journal of Nonverbal Behavior*, *28*(3), 167ï 185.

Zhang, Y., Kong, F., Zhong, Y., & Kou, H. (2014). Personality manipulations: Do they modulate facial attractiveness ratings? *Personality and Individual Differences*, *70*, 80ï 84. doi:10.1016/j.paid.2014.06.033

Appendix 1: ICAR Sample Intelligence Test

Cognitive Ability Test (ICAR)

Permission to include a shortened ICAR sample test in this thesis was granted via personal communication with the ICAR team, but for test security, only four example items are presented (one item from each item type category) and no answers to the items are provided. For more information about the psychometric properties of this 16-item ñICAR Sample Testò, please refer to ñThe international cognitive ability resource: Development and initial validation of a public-domain measureò (Condon & Revelle, 2014). These items are examples of the four item types described in Chapter 2 and Chapter 5: verbal reasoning, letter and number series, matrix reasoning, and mental rotation. Test questions were presented to participants one-by-one in a random order.

Verbal Reasoning:

1. (VR) Zach is taller than Matt and Richard is shorter than Zach. Which of the following statements would be most accurate?

Richard is taller than Matt, Richard is shorter than Matt, Richard is as tall as Matt, It's impossible to tell, Richard is taller than Zach, Zach is shorter than Matt, Zach is shorter than Matt, none of these, I don't know

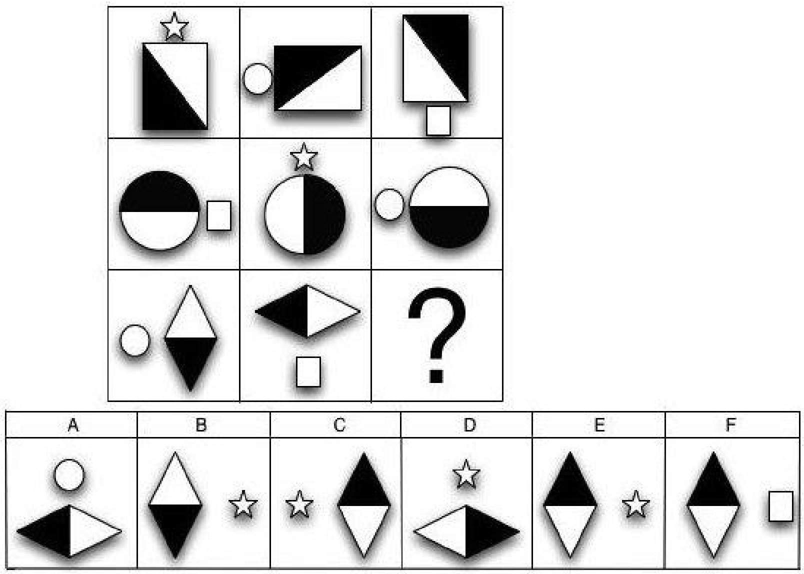
Letter and Number Series:

2. (LN) In the following alphanumeric series, what letter comes next?
V, Q, M, J, H...

E, F, G, H, I, J, none of these, I don't know

Matrix Reasoning Items

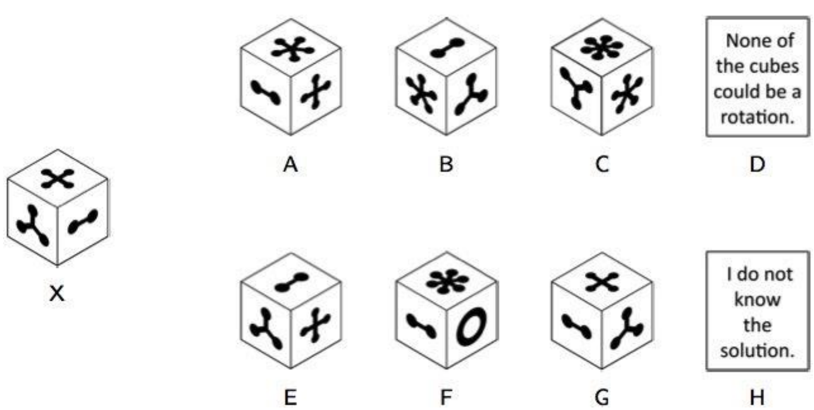
3. (MR) Please identify which of six geometric shapes presented as response choices will best complete the stimuli.



A, B, C, D, E, F, none of these, I don't know

Three-Dimensional Rotation Items

4. (R3D) Please identify which of the response choices is a possible rotation of the target stimuli.



A, B, C, D, E, F, G, H, none of these, I don't know

Appendix 2: Ethics Application Forms

University of St Andrews

University Teaching and Research Ethics Committee
Sub-committee

19 February 2014

Ethics Reference No: *Please quote this ref on all correspondence*	PS10828
Project Title:	Influences in the perception of intelligence in faces – Online Study
Researcher's Name:	Sean Talamas
Supervisor:	Professor David Perrett

Thank you for submitting your application which was considered at the Psychology & Neuroscience School Ethics Committee meeting on the 12th February 2014. The following documents were reviewed:

1. Ethical Application Form	18/02/2014
2. Advertisement	18/02/2014
3. Participant Information Sheet	18/02/2014
4. Consent Form	18/02/2014
5. Debriefing Form	18/02/2014
6. Questionnaire	18/02/2014
7. Data Management Plan	18/02/2014

The University Teaching and Research Ethics Committee (UTREC) approves this study from an ethical point of view. Please note that where approval is given by a School Ethics Committee that committee is part of UTREC and is delegated to act for UTREC.

Approval is given for three years. Projects, which have not commenced within two years of original approval, must be re-submitted to your School Ethics Committee.

You must inform your School Ethics Committee when the research has been completed. If you are unable to complete your research within the 3 three year validation period, you will be required to write to your School Ethics Committee and to UTREC (where approval was given by UTREC) to request an extension or you will need to re-apply.

Any serious adverse events or significant change which occurs in connection with this study and/or which may alter its ethical consideration, must be reported immediately to the School Ethics Committee, and an Ethical Amendment Form submitted where appropriate.

Approval is given on the understanding that the 'Guidelines for Ethical Research Practice' https://www.st-andrews.ac.uk/utrec/guidelines/ are adhered to.

Yours sincerely

Convenor of the School Ethics Committee

Ccs Prof D. Perrett (Supervisor)
School Ethics Committee

School of Psychology & Neuroscience, St Mary's Quad, South Street, St Andrews, Fife KY16 9JP
Email: psyethics@st-andrews.ac.uk Tel: 01334 462071

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600 YEARS
1413 – 2013

Project Title	Influences in the perception of intelligence in faces – Online Study
Researcher's Name	Sean Talamas
Supervisor	Professor David Perrett
Department/Unit	School of Psychology & Neuroscience
Ethical Approval Code (Approval allocated to Original Application)	PS10828
Original Application Approval Date	18 February 2014
Amendment Application Approval	06 April 2015

Ethical Amendment Approval

Thank you for submitting your amendment application which was considered at the Psychology & Neuroscience School Ethics Committee meeting on the 24th March 2015. The following documents were reviewed:

1.	Ethical Amendment Application Form	06/04/2015
2.	Participant Information Sheet	06/04/2015
3.	Debriefing Form	06/04/2015
4.	Questionnaire	06/04/2015

The University Teaching and Research Ethics Committee (UTREC) approves this study from an ethical point of view. Please note that where approval is given by a School Ethics Committee that committee is part of UTREC and is delegated to act for UTREC.

Approval is given for three years from the original application only. Ethical Amendments do not extend this period but give permission to an amendment to the original approval research proposal only. If you are unable to complete your research within the original 3 three year validation period, you will be required to write to your School Ethics Committee and to UTREC (where approval was given by UTREC) to request an extension or you will need to re-apply. You must inform your School Ethics Committee when the research has been completed.

Any serious adverse events or significant change which occurs in connection with this study and/or which may alter its ethical consideration, must be reported immediately to the School Ethics Committee, and an Ethical Amendment Form submitted where appropriate.

Approval is given on the understanding that the 'Guidelines for Ethical Research Practice' (http://www.st-andrews.ac.uk/media/UTRECguidelines%20Feb%2008.pdf) are adhered to.

Yours sincerely

Convenor of the School Ethics Committee

Ccs Prof D. Perrett (Supervisor)
School Ethics Committee

School of Psychology & Neuroscience, St Mary's Quad, South Street, St Andrews, Fife KY16 9JP
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600 YEARS
1413 – 2013

Project Title	Influences in the perception of intelligence in faces – Online study
Researcher's Name	Sean Talamas
Supervisor	Dave Perrett
Department/Unit	School of Psychology & Neuroscience
Ethical Approval Code (Approval allocated to Original Application)	PS10828
Original Application Approval Date	18 February 2014
Amendment Application Approval	23 April 2014

Ethical Amendment Approval

Thank you for submitting your amendment application which was considered at the Psychology & Neuroscience School Ethics Committee meeting on the 23rd April 2014. The following documents were reviewed:

1. Ethical Amendment Application Form 23/04/2014
2. Participant Information Sheet 23/04/2014
3. Consent Form 23/04/2014
4. Questionnaire 23/04/2014

The University Teaching and Research Ethics Committee (UTREC) approves this study from an ethical point of view. Please note that where approval is given by a School Ethics Committee that committee is part of UTREC and is delegated to act for UTREC.

Approval is given for three years from the original application only. Ethical Amendments do not extend this period but give permission to an amendment to the original approval research proposal only. If you are unable to complete your research within the original 3 three year validation period, you will be required to write to your School Ethics Committee and to UTREC (where approval was given by UTREC) to request an extension or you will need to re-apply. You must inform your School Ethics Committee when the research has been completed.

Any serious adverse events or significant change which occurs in connection with this study and/or which may alter its ethical consideration, must be reported immediately to the School Ethics Committee, and an Ethical Amendment Form submitted where appropriate.

Approval is given on the understanding that the 'Guidelines for Ethical Research Practice' (http://www.st-andrews.ac.uk/media/UTRECguidelines%20Feb%2008.pdf) are adhered to.

Yours sincerely

Convenor of the School Ethics Committee

Ccs Prof D. Perrett (Supervisor)
School Ethics Committee

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600 YEARS
1413 – 2013

Project Title	Influences in the perception of intelligence in faces – In lab study
Researcher's Name	Sean Talamas
Supervisor	Professor David Perrett
Department/Unit	School of Psychology& Neuroscience
Ethical Approval Code (Approval allocated to Original Application)	PS10867
Original Application Approval Date	04 March 2014
Amendment Application Approval	09 June 2014

Ethical Amendment Approval

Thank you for submitting your amendment application which was considered at the Psychology & Neuroscience School Ethics Committee meeting on the 28th May 2014. The following documents were reviewed:

1. Ethical Amendment Application Form 09/06/2014
2. Advertisement 09/06/2014

The University Teaching and Research Ethics Committee (UTREC) approves this study from an ethical point of view. Please note that where approval is given by a School Ethics Committee that committee is part of UTREC and is delegated to act for UTREC.

Approval is given for three years from the original application only. Ethical Amendments do not extend this period but give permission to an amendment to the original approval research proposal only. If you are unable to complete your research within the original 3 three year validation period, you will be required to write to your School Ethics Committee and to UTREC (where approval was given by UTREC) to request an extension or you will need to re-apply. You must inform your School Ethics Committee when the research has been completed.

Any serious adverse events or significant change which occurs in connection with this study and/or which may alter its ethical consideration, must be reported immediately to the School Ethics Committee, and an Ethical Amendment Form submitted where appropriate.

Approval is given on the understanding that the 'Guidelines for Ethical Research Practice' (http://www.st-andrews.ac.uk/media/UTRECguidelines%20Feb%2008.pdf) are adhered to.

Yours sincerely

Convenor of the School Ethics Committee

Ccs Prof D. Perrett (Supervisor)
School Ethics Committee

University of St Andrews
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600 YEARS
1413 – 2013

Project Title	Influences in the perception of intelligence in faces – In lab study
Researchers' Names	Sean Talamas, Daniel Menendez, Charlotte Poynton and Stephanie Belenkov
Supervisor	Professor David Perrett
Department/Unit	School of Psychology & Neuroscience
Ethical Approval Code (Approval allocated to Original Application)	PS10867
Original Application Approval Date	04 March 2014
Amendment Application Approval	06 November 2014

Ethical Amendment Approval

Thank you for submitting your amendment application which was considered by the Psychology & Neuroscience School Ethics Committee on the 6th November 2014. The following documents were reviewed:

1. Ethical Amendment Application Form 06/11/2014
2. Participant Information Sheet 06/11/2014
3. Consent Form 06/11/2014
4. Debriefing Form 06/11/2014

The University Teaching and Research Ethics Committee (UTREC) approves this study from an ethical point of view. Please note that where approval is given by a School Ethics Committee that committee is part of UTREC and is delegated to act for UTREC.

Approval is given for three years from the original application only. Ethical Amendments do not extend this period but give permission to an amendment to the original approval research proposal only. If you are unable to complete your research within the original 3 three year validation period, you will be required to write to your School Ethics Committee and to UTREC (where approval was given by UTREC) to request an extension or you will need to re-apply. You must inform your School Ethics Committee when the research has been completed.

Any serious adverse events or significant change which occurs in connection with this study and/or which may alter its ethical consideration, must be reported immediately to the School Ethics Committee, and an Ethical Amendment Form submitted where appropriate.

Approval is given on the understanding that the 'Guidelines for Ethical Research Practice' (http://www.st-andrews.ac.uk/media/UTRECguidelines%20Feb%2008.pdf) are adhered to.

Yours sincerely

Convenor of the School Ethics Committee

Ccs Prof D. Perrett (Supervisor)
School Ethics Committee

School of Psychology & Neuroscience, St Mary's Quad, South Street, St Andrews, Fife KY16 9JP
Email: psyethics@st-andrews.ac.uk Tel: 01334 462071

University of St Andrews
from first to foremost

600 YEARS
1413 – 2013

Project Title	Influences in the perception of intelligence in faces – In lab study
Researcher's Name	Sean Talamas
Supervisor	Professor David Perrett
Department/Unit	School of Psychology & Neuroscience
Ethical Approval Code (Approval allocated to Original Application)	PS10867
Original Application Approval Date	04 March 2014
Amendment Application Approval	12 March 2014

Ethical Amendment Approval

Thank you for submitting your amendment application which was considered at the Psychology & Neuroscience School Ethics Committee meeting on the 12th March 2014. The following documents were reviewed:

1. Ethical Amendment Application Form 12/03/2014
2. Questionnaire 12/03/2014

The University Teaching and Research Ethics Committee (UTREC) approves this study from an ethical point of view. Please note that where approval is given by a School Ethics Committee that committee is part of UTREC and is delegated to act for UTREC.

Approval is given for three years from the original application only. Ethical Amendments do not extend this period but give permission to an amendment to the original approval research proposal only. If you are unable to complete your research within the original 3 three year validation period, you will be required to write to your School Ethics Committee and to UTREC (where approval was given by UTREC) to request an extension or you will need to re-apply. You must inform your School Ethics Committee when the research has been completed.

Any serious adverse events or significant change which occurs in connection with this study and/or which may alter its ethical consideration, must be reported immediately to the School Ethics Committee, and an Ethical Amendment Form submitted where appropriate.

Approval is given on the understanding that the 'Guidelines for Ethical Research Practice' (http://www.st-andrews.ac.uk/media/UTRECguidelines%20Feb%2008.pdf) are adhered to.

Yours sincerely

Convenor of the School Ethics Committee

Ccs Prof D. Perrett (Supervisor)
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Project Title	Influences in the perception of intelligence in faces – In lab study
Researcher's Name	Sean Talamas
Supervisor	Dave Perrett
Department/Unit	School of Psychology & Neuroscience
Ethical Approval Code (Approval allocated to Original Application)	PS10867
Original Application Approval Date	04 March 2014
Amendment Application Approval	23 April 2014

Ethical Amendment Approval

Thank you for submitting your amendment application which was considered at the Psychology & Neuroscience School Ethics Committee meeting on the 23rd April 2014. The following documents were reviewed:

1. Ethical Amendment Application Form 23/04/2014
2. Advertisement 23/04/2014
3. Participant Information Sheet 23/04/2014
4. Consent Form 23/04/2014

The University Teaching and Research Ethics Committee (UTREC) approves this study from an ethical point of view. Please note that where approval is given by a School Ethics Committee that committee is part of UTREC and is delegated to act for UTREC.

Approval is given for three years from the original application only. Ethical Amendments do not extend this period but give permission to an amendment to the original approval research proposal only. If you are unable to complete your research within the original 3 three year validation period, you will be required to write to your School Ethics Committee and to UTREC (where approval was given by UTREC) to request an extension or you will need to re-apply. You must inform your School Ethics Committee when the research has been completed.

Any serious adverse events or significant change which occurs in connection with this study and/or which may alter its ethical consideration, must be reported immediately to the School Ethics Committee, and an Ethical Amendment Form submitted where appropriate.

Approval is given on the understanding that the 'Guidelines for Ethical Research Practice' (http://www.st-andrews.ac.uk/media/UTRECguidelines%20Feb%2008.pdf) are adhered to.

Yours sincerely

Convenor of the School Ethics Committee

Ccs Prof D. Perrett (Supervisor)
School Ethics Committee

University of St Andrews
from first to foremost

600 YEARS
1413 – 2013

Project Title	Individual Differences in the Perception of Facial Attractiveness
Researcher's Name	Sean Talamas
Supervisor	Professor David Perrett
Department/Unit	School of Psychology & Neuroscience
Ethical Approval Code (Approval allocated to Original Application)	PS11165
Original Application Approval Date	30 September 2014
Amendment Application Approval	28 January 2015

Ethical Amendment Approval

Thank you for submitting your amendment application which was considered at the Psychology & Neuroscience School Ethics Committee meeting on the 27th January 2015. The following documents were reviewed:

1. Ethical Amendment Application Form 28/01/2015

The University Teaching and Research Ethics Committee (UTREC) approves this study from an ethical point of view. Please note that where approval is given by a School Ethics Committee that committee is part of UTREC and is delegated to act for UTREC.

Approval is given for three years from the original application only. Ethical Amendments do not extend this period but give permission to an amendment to the original approval research proposal only. If you are unable to complete your research within the original 3 three year validation period, you will be required to write to your School Ethics Committee and to UTREC (where approval was given by UTREC) to request an extension or you will need to re-apply. You must inform your School Ethics Committee when the research has been completed.

Any serious adverse events or significant change which occurs in connection with this study and/or which may alter its ethical consideration, must be reported immediately to the School Ethics Committee, and an Ethical Amendment Form submitted where appropriate.

Approval is given on the understanding that the 'Guidelines for Ethical Research Practice' (http://www.st-andrews.ac.uk/media/UTRECguidelines%20Feb%2008.pdf) are adhered to.

Yours sincerely

Convenor of the School Ethics Committee

Ccs Prof D. Perrett (Supervisor)
School Ethics Committee

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University of St Andrews

University Teaching and Research Ethics Committee
Sub-committee

2 October 2014

Ethics Reference No: *Please quote this ref on all correspondence*	PS11165
Project Title:	Individual Differences in the Perceptions of Facial Attractiveness
Researchers' Names:	Sean Talamas, Hugo Trad, Louise Milligan, Emma Martin, Rebecca Munns, Olivia Ives and Katie Harrison
Supervisor:	Professor David Perrett

Thank you for submitting your application which was considered at the Psychology & Neuroscience School Ethics Committee meetings held on the 2nd July and 24th September 2014. The following documents were reviewed:

1.	Ethical Application Form	30/09/2014
2.	Advertisement	30/09/2014
3.	Participant Information Sheet	30/09/2014
4.	Consent Form	30/09/2014
5.	Debriefing Forms	30/09/2014
6.	Questionnaires	30/09/2014
7.	Data Management Plan	30/09/2014

The University Teaching and Research Ethics Committee (UTREC) approves this study from an ethical point of view. Please note that where approval is given by a School Ethics Committee that committee is part of UTREC and is delegated to act for UTREC.

Approval is given for three years. Projects, which have not commenced within two years of original approval, must be re-submitted to your School Ethics Committee.

You must inform your School Ethics Committee when the research has been completed. If you are unable to complete your research within the 3 three year validation period, you will be required to write to your School Ethics Committee and to UTREC (where approval was given by UTREC) to request an extension or you will need to re-apply.

Any serious adverse events or significant change which occurs in connection with this study and/or which may alter its ethical consideration, must be reported immediately to the School Ethics Committee, and an Ethical Amendment Form submitted where appropriate.

Approval is given on the understanding that the 'Guidelines for Ethical Research Practice' https://www.st-andrews.ac.uk/utrec/guidelines/ are adhered to.

Yours sincerely

Convenor of the School Ethics Committee

Ccs School Ethics Committee
Prof D Perrett (Supervisor)

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Email: psyethics@st-andrews.ac.uk, Tel: 01334 462071