Terms and Conditions of Use of Digitised Theses from Trinity College Library Dublin

Copyright statement

All material supplied by Trinity College Library is protected by copyright (under the Copyright and Related Rights Act, 2000 as amended) and other relevant Intellectual Property Rights. By accessing and using a Digitised Thesis from Trinity College Library you acknowledge that all Intellectual Property Rights in any Works supplied are the sole and exclusive property of the copyright and/or other IPR holder. Specific copyright holders may not be explicitly identified. Use of materials from other sources within a thesis should not be construed as a claim over them.

A non-exclusive, non-transferable licence is hereby granted to those using or reproducing, in whole or in part, the material for valid purposes, providing the copyright owners are acknowledged using the normal conventions. Where specific permission to use material is required, this is identified and such permission must be sought from the copyright holder or agency cited.

Liability statement

By using a Digitised Thesis, I accept that Trinity College Dublin bears no legal responsibility for the accuracy, legality or comprehensiveness of materials contained within the thesis, and that Trinity College Dublin accepts no liability for indirect, consequential, or incidental, damages or losses arising from use of the thesis for whatever reason. Information located in a thesis may be subject to specific use constraints, details of which may not be explicitly described. It is the responsibility of potential and actual users to be aware of such constraints and to abide by them. By making use of material from a digitised thesis, you accept these copyright and disclaimer provisions. Where it is brought to the attention of Trinity College Library that there may be a breach of copyright or other restraint, it is the policy to withdraw or take down access to a thesis while the issue is being resolved.

Access Agreement

By using a Digitised Thesis from Trinity College Library you are bound by the following Terms & Conditions. Please read them carefully.

I have read and I understand the following statement: All material supplied via a Digitised Thesis from Trinity College Library is protected by copyright and other intellectual property rights, and duplication or sale of all or part of any of a thesis is not permitted, except that material may be duplicated by you for your research use or for educational purposes in electronic or print form providing the copyright owners are acknowledged using the normal conventions. You must obtain permission for any other use. Electronic or print copies may not be offered, whether for sale or otherwise to anyone. This copy has been supplied on the understanding that it is copyright material and that no quotation from the thesis may be published without proper acknowledgement.
An investigation into the role of visual and auditory information in evaluations of attractiveness

Brendan Cullen
B.Sc. M.Sc.

A thesis submitted in fulfilment of the requirements for the degree of Doctor or Philosophy to the University of Dublin, Trinity College

Supervisor: Professor Fiona N Newell
Department of Psychology
October 2014
Declaration

I declare that this thesis has not been submitted as an exercise for a degree at this or any other university and it is entirely my own work.

I agree to deposit this thesis in the University’s open access institutional repository or allow the library to do so on my behalf, subject to Irish Copyright Legislation and Trinity College Library conditions of use and acknowledgment.

Brendan Cullen

[Signature]

Brendan Cullen
Summary

Attraction is the initial basis on which the vast majorities of our friendships and relationships are formed. Information for judging attractiveness can be derived from any sensory input however the greater part of the research concerning the subject has primarily focused on visual information, specifically the face and its physical characteristics. On a basic evolutionary level the physical characteristics of an attractive face, such as averageness or symmetry, can indicate the ability of that individual to tolerate environmental or genetic stressors making them a potentially desirable partner. However the evaluation of multiple sensory inputs as well as evaluation of non-physical information allows for a greater understanding of how attractiveness judgements are formed in reality.

The studies reported here aim to address some of these shortcomings by attempting to better understand the mechanisms and differences in the evaluation of others in terms of attractiveness. Three main questions are addressed in this thesis, the first concerns the role of social information about an individual and its impact on their perceived attractiveness (Chapter 2). Specifically I investigated whether or not ratings of attractiveness for faces could be influenced by simultaneously presented cross-sensory social information which was either neutral or humorous in nature. The second research question I addressed was the changes in evaluation of a face as a function of exposure to that face (Chapter 3). The mere exposure effect states that simply increasing exposure to a stimulus increases the liking for that stimulus. I sought to examine whether or not the mere exposure effect for a face could be influenced
by the emotional expression of that face, the proportion of expressiveness of overall exposure and the nature of the presentation of the stimulus itself.

The remaining experimental chapters of this thesis (Chapters 4, 5 & 6) sought to examine some of the differences in evaluation of faces and voices for attractiveness by adults of different ages. The bulk of our understanding of the attractiveness of faces and voices has been drawn from the responses of younger adult participants, mostly in responses to stimuli of a similar age, with middle aged and particularly older adults being vastly under represented. As we age additional experience as well as changing preferences and motivations may result in changes to how faces and voices are evaluated for attractiveness. In Chapter 4 I examine how multisensory information is evaluated by younger, middle aged and older adults. In Chapter 5 I sought to examine how older adults would evaluate faces and voices on various cognitive dimensions and whether or not the same trait correlations were present as those found in studies with younger adults. Chapter 6 sought to investigate whether or not older and younger adults would differ in their eye movements and fixations across a face when evaluating it for attractiveness.

Overall the findings of this research have demonstrated that judgements of attractiveness are driven by more complex decisions and characteristics than simply the physical dimensions of a face. While these experiments indicate that multisensory information is used in these decisions, the results indicate that both younger and older adults appear to be strongly driven by visual information in assessing others
attractiveness. The theoretical and practical implications of these findings are discussed in Chapter 7.

A number of challenges remain to gain a greater more ecologically valid understanding of attractiveness. These include testing some of the questions examined here in more naturalistic conditions outside the laboratory as well as a deeper investigation of the role of ageing in changing preferences for the evaluation of sensory information used to make attractiveness judgements.
Acknowledgements

I would like to use this opportunity to express my gratitude to a number of individuals who have directly and indirectly contributed to the completion of this thesis. First and foremost my sincerest gratitude and appreciation to my supervisor Professor Fiona Newell who has guided me through the past three years of this PhD with the highest level of support and without whom this thesis would not exist. A special thanks to Hanni Kiiski and Ludovic Hoyet from the Captavatar project who have provided an abundance of support over the past couple of years through their various areas of expertise. To everyone in the Multisensory Cognition Group I would like to extend my thanks for allowing me to continuously bother you with questions and requests for participants.

Thanks are also due to my parents Arthur and Bernadette for their support through all of my personal and academic endeavours and who provided just enough brains to get through them all. I would also like to thank Dearbhla for her unwavering support during the entirety of this PhD and particularly in the past few months. Thanks to Corrina for allowing me to ask many stupid questions as well as providing a type of support that can only come from a fellow PhD student. To Michael and Alex for getting me out every week to run which has helped hugely not only in our various marathons and other sporting challenges but has provided the mental resilience to get me through the last few months of this thesis.

Finally I would like to thank the 564 people who showed up and participated in these various experiments. In particular I would like to thank Mary Somerville for helping
me out with the recruitment and facilitation of testing of many of the older adult participants in these experiments.
Table of Contents

Declaration....................................................................................................................................... ii
Summary .......................................................................................................................................... iii
Acknowledgements ...................................................................................................................... vi
List of Tables .................................................................................................................................. xii
List of Figures ............................................................................................................................... xiv
1.0 General Introduction ................................................................................................................. 21
  1.1 “The privilege of nature”.............................................................................................................. 21
  1.2 Visual Attractiveness.............................................................................................................. 22
    1.2.1 Cognitive Theories ......................................................................................................... 24
    1.2.2 Dynamic Displays ........................................................................................................... 27
  1.3 Perceived Attractiveness of bodies ..................................................................................... 29
  1.4 Face and Body........................................................................................................................ 31
  1.5 The voice as an Auditory ‘Face’ ........................................................................................... 33
  1.6 Other Perceptual Sources ..................................................................................................... 35
  1.7 Chemistry................................................................................................................................ 36
  1.8 Non Physical Components.................................................................................................... 39
  1.9 Time and Timing .................................................................................................................... 40
  1.10 Neural Processes.................................................................................................................. 43
  1.11 Age & Attractiveness.......................................................................................................... 45
  1.12 Image Management............................................................................................................ 47
  1.13 Limitations of existing research......................................................................................... 49
  1.14 Project Background............................................................................................................. 50
  1.15 Outline of thesis................................................................................................................... 51
    1.15.1 The role of simultaneously presented cross sensory social information ............. 52
    1.15.2 The role of frequency of exposure in attractiveness judgements ....................... 52
    1.15.3 Ageing and evaluation of faces and voices ............................................................... 52
2.0 The role of simultaneously presented cross-sensory social information on judgments of attractiveness ........................................................................................................... 54
  2.1 Introduction .......................................................................................................................... 54
  2.2 Method .................................................................................................................................. 59
  2.3 Results ..................................................................................................................................... 65
  2.4 Discussion ............................................................................................................................... 69
  2.5 Conclusion ................................................................................................................................ 74
List of Tables

Table 1: This table illustrates some of the most typical approaches to establishing a MEE, table shows the number of exposures per face identity, nature of presenting stimuli, expression used, presentation of rating phase.................................................80

Table 2: This table illustrates the relative proportion of expressive frequency each facial identity was shown within a block. All faces were shown an equal number of times but differed in how often they may have been show smiling or angry relative to neutral. Faces were shown in a pseudo-random and discrete manner.....................105

Table 3: This table illustrates the manner in which relative frequency of expression was shown throughout a single continuous exposure to a face. The above example shows how ‘happy’ (H) expressions were embedded into a sequence with their ‘neutral’ (N) counterparts. The same manner was used for blocks containing ‘angry’ expressions. Face identities were shown in random order.................................112

Table 4: Correlations for ratings of faces made in the Vision only and AV conditions. No significant correlations with Vision only ratings were evident for either congruency conditions in the AV condition......................................................................................152

Table 5: A series of Spearmans correlations were carried out on all possible pairs of dimensions to determine any relationship. Values marked in red indicate where one trait is significant correlated with another, p<.05. Correlations are in the positive direction unless preceded by a – symbol. .................................................................181

Table 6: Correlations for each trait across Young Aged face stimuli. Values marked in red indicate a significant correlation p<.05. ..........................................................................................183

Table 7: Correlations for each trait across Middle Aged face stimuli. Values marked in red indicate a significant correlation p<.05. ..........................................................................................183

Table 8: Correlations for each trait across Older Aged face stimuli. Values marked in red indicate a significant correlation p<.05. ..........................................................................................183
Table 9: A series of Spearman's correlations were carried out on the ratings to the voice stimuli on all possible pairs of dimensions to determine any relationship. Values marked in red indicate where one trait is significantly correlated with another, p<.05.

Table 10: Correlations for each trait across Young Aged voice stimuli. Values marked in red indicate a significant correlation p<.05.

Table 11: Correlations for each trait across Middle Aged voice stimuli. Values marked in red indicate a significant correlation p<.05.

Table 12: Correlations for each trait across Older Aged voice stimuli. Values marked in red indicate a significant correlation p<.05.
List of Figures

Figure 2.1: Sample images of edited faces used in current study ........................................ 61

Figure 2.2: Mean attractiveness ratings for each vocal condition. Faces associated with humorous statements were rated as being more attractive than faces associated with non-humorous statements only ........................................................................................................... 66

Figure 2.3: Rating of attractiveness for sex of stimulus by vocal condition. Female faces were rated as being more attractive than male faces across all conditions ................................................................................................................................ 67

Figure 2.4: Mean attractiveness rating for faces that were high/medium/low attractiveness. No interaction between attractiveness of face and vocal condition was observed. Consistent with a previous rating study faces were rated ........................................ 68

Figure 2.5: Mean attractiveness rating for each vocal condition by female and male participants. No significant difference between female and male participants was observe ................................................................................................................................. 69

Figure 3.1: This example depicts some of the faces and how they were edited for use in the current rating study and subsequent experiments. Faces in the rating study were shown individually and rated for attractiveness .................................................................................. 85

Figure 3.2: Mean attractiveness ratings given to faces by participants located in Western Europe/United States and those located in Eastern/Asian locations. SE bars are shown ................................................................................................................................. 87

Figure 3.3: Mean attractiveness ratings given to male and female faces by participants located in Western Europe/United States and those located in Eastern/Asian locations. SE bars are shown ................................................................................................................................. 87

Figure 3.4: Plot shows mean attractiveness rating given by European/US participants to female and male faces. SE bars are shown ................................................................................................................................. 89
Figure 3.5: Plot shows mean attractiveness scores for faces by expression and number of exposures. In this experiment the exposure faces and rating faces were identical. SE bars of the mean are shown..........................93

Figure 3.6: Plot shows mean attractiveness rating for female faces by expression and number of exposures. SE bars of the mean are shown..........................94

Figure 3.7: Plot shows mean attractiveness rating for male faces by expression and number of exposures. SE bars of the mean are shown..........................94

Figure 3.8: Plot shows mean attractiveness rating for male and female faces given by the online group following a single exposure and the experimental group following six exposures. There was a significant difference in ratings given by each group. SE bars of the mean are shown..........................95

Figure 3.9: Plot shows mean attractiveness rating for faces by expression and number of exposures. In this experiment the face shown during the rating phase was always the neutral version regardless of the expression it was seen with during the exposure phase. SE bars are shown........................................99

Figure 3.10: Plot shows mean attractiveness rating for female faces by expression and number of exposures. SE bars of the mean are shown..........................100

Figure 3.11: Plot shows mean attractiveness rating for male faces by expression and number of exposures. SE bars of the mean are shown..........................101

Figure 3.12: Plot shows mean attractiveness rating for male and female faces given by the online group following a single exposure and the experimental group following six exposures. There was a significant difference in ratings given by each group. SE bars of the mean are shown........................................102

Figure 3.13: Plot shows comparison for mean attractiveness rating for faces that were seen fully as one expression and not a proportionate amount of expression. SE bars of the mean are shown........................................104
Figure 3.14: Plot shows the mean attractiveness rating given to faces seen in Happy or Angry expressions where presentation of stimuli were discontinuous. SE bars of the mean are shown...............................................................107

Figure 3.15: Plot shows mean attractiveness rating across each proportion level and expression for female faces. SE bars of the mean are shown.................................108

Figure 3.16: Plot shows mean attractiveness rating across each proportion level and expression for male faces. SE bars of the mean are shown.................................108

Figure 3.17: Plot shows mean attractiveness rating for male and female faces given by the online group following a single exposure and the experimental group following six exposures. There was a significant difference in ratings given by each group. SE bars of the mean are shown...............................................................109

Figure 3.18: Plot shows comparison for mean attractiveness rating for faces that were seen fully as one expression and not a proportionate amount of expression. SE bars of the mean are shown...............................................................113

Figure 3.19: Plot shows mean attractiveness rating given to faces seen in Happy or Angry expressions where presentation of stimuli was proportionate and continuous. SE bars of the mean are shown...............................................................114

Figure 3.20: Plot shows mean attractiveness rating across each proportion level and expression for female faces. SE bars of the mean are shown.................................115

Figure 3.21: Plot shows mean attractiveness rating across each proportion level and expression for male faces. SE bars of the mean are shown.................................115

Figure 3.22: Plot shows mean attractiveness rating for male and female faces given by the online group following a single exposure and the experimental group following six exposures. There was a significant difference in ratings given by each group. SE bars of the mean are shown...............................................................116
Figure 4.1: Mean attractiveness ratings for age of face as rated by each age group of participants in Experiment 1. SE bars of the mean are shown.

Figure 4.2: Mean attractiveness ratings for age and sex of stimulus as rated by each age group of participant. SE bars of the mean are shown.

Figure 4.3: Mean attractiveness ratings for age of stimulus as rated by female and male participants. No effect of participant sex was observed. SE bars of the mean are shown.

Figure 4.4: Mean guessed age of each stimulus age group compared to the actual mean age of the stimulus age group. Overall participants mean guessed age was consistent with the actual mean age of the face group, with the exception of faces in the older age category.

Figure 4.5: Mean attractiveness rating for each age of voice by the age of the participant in Experiment 2. SE bars of the mean are shown.

Figure 4.6: Mean attractiveness rating for each age of stimulus by the age of the participant by the sex of stimulus. SE bars of the mean are shown.

Figure 4.7: Mean attractiveness ratings for age of stimulus as rated by female and male participants. SE bars of the mean are shown.

Figure 4.8: Mean guessed age of each stimulus age group compared to the actual mean age of the stimulus age group.

Figure 4.9: Mean attractiveness rating for congruency of stimulus age by the age of the participant. Age congruent stimuli were rated as being more attractive than incongruent stimuli. SE bars of the mean are shown.

Figure 4.10: Mean attractiveness ratings for age of stimulus as rated by female and male participants. SE bars of the mean are shown.

Figure 4.11: Mean guessed age of each stimulus age group compared to the actual mean age of the stimulus age group.
Figure 5.1: An example of face stimuli featuring younger, middle aged and older adult faces...

Figure 5.2: Mean rating for each cognitive dimension across all participants, according to the age of the face stimulus. SE bars of the mean are shown.

Figure 5.3: Mean rating for each cognitive dimension and age of the face are plotted above. Significant negative correlations were observed between age and attractiveness, competence, familiarity and trustworthiness.

Figure 5.4: This figure shows all the significant correlations observed between trait pairs in the visual condition. Each trait and its corresponding correlated trait are outlined on the X and Y axes of each plot with the rating scale of 1 – 7 for each trait at the origin point. Trend lines are marked in red.

Figure 5.5: This graph illustrates the mean rating given by each sex of participant to each trait dimension for faces. Only competence was found to be evaluated significantly different male and female participants, with males giving higher ratings of competence to faces. SE bars of the mean are shown here.

Figure 5.6: Mean rating for each cognitive dimension across all participants, according to the age of the voice stimulus. SE bars of the mean are shown.

Figure 5.7: Correlations for each trait across the age of the voice. No significant correlations between the age of the voice stimuli and any of the traits was observed.

Figure 5.8: This figure shows all the significant correlations observed between trait pairs in the visual condition. Each trait and its corresponding correlated trait are outlined on the X and Y axes of each plot with the rating scale of 1 – 7 for each trait at the origin point. Trend lines are marked in red.

Figure 5.9: This graph illustrates the mean ratings given by participants in each sex group to each trait dimension for voices. Only familiarity was found to be evaluated significantly differently by male and female participants, with males giving higher...
ratings of familiarity to the voices. SE bars of the mean are shown here.

---

**Figure 6.1:** Sample of defined AOIs. Eye AOI (1) and mouth AOI (2) regions were selected for visual saliency and role in age and attractiveness perception and are represented by the yellow rectangles. The 'Other Areas' AOI (3) is the remaining area outside of the yellow rectangles.

---

**Figure 6.2:** Mean attractiveness rating for each age of stimulus by the age of the participant. Younger face stimuli were rated as being more attractive than older face stimuli. There was no significant difference in how the groups rated the faces. SE bars of the mean are shown.

---

**Figure 6.3:** Mean attractiveness rating for high and low attractiveness faces by the age of the participant. As expected high attractiveness face stimuli were rated as being more attractive than low attractiveness stimuli. There was no significant difference in how the groups rated the faces. SE bars of the mean are shown.

---

**Figure 6.4:** Mean number of fixations for AOIs for the age of the face and age of participant. Eyes attracted more fixations than the Mouth or Other AOIs. Number of fixations also significantly differed between Mouth and Other AOI, with the Other AOI attracting more fixations than the Mouth AOI.

---

**Figure 6.5:** Mean duration of fixations for AOIs for the age of the face and age of participant. Eyes attracted more fixation duration than the Mouth or Other AOIs. Duration of fixations did not significantly differ between Mouth and Other AOI.

---

**Figure 6.6:** Mean number of fixations for high and low attractive faces by the age of the participant. The attractiveness of the face had no significant difference on the mean number of fixations made by participants.

---

**Figure 6.7:** Older adult participant fixation heat map for younger face stimuli. Warmer colours indicate higher concentration of fixations. Younger female face based on 522 total fixations. Younger male face based on 486 total fixations.
Figure 6.8: Older adult participant fixation heat map for older face stimuli. Warmer colours indicate higher concentration of fixations. Older female face based on 521 total fixations. Younger male face based on 516 total fixations.

Figure 6.9: Younger adult participant fixation heat map for younger face stimuli. Warmer colours indicate higher concentration of fixations. Younger female face based on 516 total fixations. Younger male face based on 521 total fixations.

Figure 6.10: Younger adult participant fixation heat map for older face stimuli. Warmer colours indicate higher concentration of fixations. Older female face based on 515 total fixations. Older male face based on 536 total fixations.

Figure 6.11: Mean number of fixations for left and ride side of the faces by the age of the participant. Although not significant the means here suggest that older and younger adults may differ in which side of the face they attend to more.

Figure 6.12: Mean number of fixations for left and ride side of the faces by the age of the face by the age of the participant. There was no significant difference in the side attended to based on the age of the face. SE bars of the mean are shown.
1.0 General Introduction

The majority of social relationships are based on an initial attraction to a person. Finding another person who is attractive to us can be modulated by multiple sources of information ranging from perceptual inputs to socially relevant information about that person. For the purposes of the current review attractiveness will be defined firstly in terms of the physical characteristics of attractiveness, which, broadly speaking forms the basis for initial attraction. It will examine physical attractiveness from a number of sensory inputs, predominantly vision and sound. The review will also examine some of the non-physical components of attractiveness such as social information and how we present ourselves. Other considerations such as the underlying cognitive and neurological processes will be examined as well as how attractiveness of an individual can be modulated over time.

1.1 “The privilege of nature”

Plato referred to beauty as the ‘privilege of nature’. This observance was based on the impression that those considered to be attractive were treated differently and more positively than those who were not. Dion & Berscheid (1972) tested this hypothesis in their classic study entitled “What is beautiful is good”. In their study they found that physically attractive individuals were perceived to be happier, better at their jobs and relationships, and possessed more desirable personality traits than average looking or unattractive looking individuals. The result from this initial study has been borne out in many other studies (Brand et al., 2011; Bruckert, Bestelmeyer & Latinus, 2010; Gross & Crofton, 1977) and has highlighted the need for a better
1.0 General Introduction

understanding of attractiveness and how it may relate to physical, cognitive and social factors. As there are such a broad range of factors mediating attractiveness this review will start by firstly examining some of the perceptual inputs that contribute information relevant for attractiveness.

1.2 Visual Attractiveness

For humans, and many other animals, visual information can dominate many perceptual tasks, therefore it is appropriate to begin examining attractiveness in terms of visual perception. No property of attractiveness has received more widespread attention than the face. What makes a face appear to be attractive? Is it the proportions, the texture of the skin or even the expression? Early work in the area varied in its approach to these questions. For example, Perrin (1921) asked his participants to think of their friends and identify what characteristics made them attractive or not. The results suggested it was merely a matter of good grooming. Other early studies examining proportions in both body and face noted a general preference for averageness and symmetry. Galton (1878) was able to use basic superimposing techniques on images of faces to demonstrate that an averaged face constructed with images of multiple individual faces was deemed more attractive than any one of its single constituent images. Since then this result has been repeatedly replicated (Grammer & Thornhill, 1994; Halbertsdadt & Rhodes, 2003, Langlois & Roggman, 1990). Such an idea may seem unlikely as we tend to associate beauty with being exceptional or distinctive rather than faces that possesses average features.

Perrett (2010) suggested that averaging faces can remove small asymmetries present in the original faces or that skin texture and blemishes would not only be smoothed
out but also make the person appear younger. A number of studies have aimed to

tackle some of these issues to better understand averageness and attractiveness.

Rhodes & Tremewan (1996) showed that manipulating the features in the individual
face to be closer to the average increased ratings of attractiveness. Other studies
have found that even controlling for skin texture by averaging other features and
leaving the skin texture unchanged still produced a preference for an averaged face
over original ones (Benson & Perrett, 1992; Little & Hancock, 2002;). Valentine,
Darling & Donnelly (2004) also demonstrated a preference for average faces even in
a profile view where symmetry was not present.

Concerns that averageness represent a cultural preference were addressed by
Apicella et al. (2007) who found that participants showed a preference for
averageness in faces across cultures, even in relatively isolated cultures such as the
Hadza of northern Tanzania who were unlikely to have preferences modulated by the
same type of media or culture. A number of theories that have been proposed to
account for a preference for averageness tend toward it being a signal for good mate
quality (Gangestad & Buss, 1993; Moller & Swaddle, 1997;). They argue that the closer
a face is to the statistical average the more likely it is to be developmentally stable
and thus represent better heritability of genes, or that average features may
represent an optimal expression for those features for example nose and breathing.

Facial symmetry is also considered to be as important as averageness when it comes
to facial attractiveness, with theories also proposing an evolutionary advantage
(Komori et al., 2009, Perrett et al., 1999). Studies suggest that asymmetries present
in human faces may signal genetic mutations and a lack of ability to tolerate
1.0 General Introduction

environmental or genetic stresses (Livshits & Kobyliansk, 1989; Thornhill & Gangestad, 1999). However when considering facial attractiveness and symmetry, some research has revealed divergent points of view. A number of studies have indicated that although ratings of attractiveness increased for increasingly symmetric faces, perfectly symmetric faces were found to be less attractive than slightly asymmetric ones (Kownar, 1996; Samuels et al., 1994). Rhodes et al. (1999) suggested that the manner in which images of symmetrical faces were constructed introduced unnatural proportions for features like nose width or eye spacing. A nose that is bent slightly off centre may appear much larger or smaller when reflected through the facial midline, similarly a slight difference in distance of the eye to the centre line may make them look too close together or too far apart. To address these concerns, Perrett et al. (1999) took a methodical approach to how the symmetrical face was actually constructed. By manually selecting around 225 predefined feature points on the face, for example left corner of the mouth, and then averaging the vertical and horizontal position of those points relative to a midline perpendicular to the interpupillary line, they demonstrated that when shape and texture symmetry were properly controlled for in this manner, there was a preference for perfectly symmetrical faces over slightly asymmetric natural ones.

1.2.1 Cognitive Theories

Several proximate mechanismcs have been proposed to explain this preference for symmetry, (Enquist & Arak, 1994; Enquist & Johnstone, 1997; Johnstone, 1994). The core idea suggested by these theories is that the preference for symmetry has emerged as result of a general sensory bias towards symmetrical stimuli. When
objects or faces are seen, a prototype representing the different versions of that stimulus that have been encountered is formed. In order to best represent a class of object the prototype representation will likely be more symmetrical than its individual exemplars in order to best represent the majority of those exemplars. New objects or faces encountered will be compared to this stored prototype, those objects that are more symmetrical are more likely to closely match this prototype and so are preferred. While this theory may account for the processing of novel face stimuli it is unable to adequately explain certain preferences for already familiar face stimuli.

Although most faces naturally contain a certain amount of asymmetry a number of studies have demonstrated that when a highly symmetrical version of already familiar faces are presented, these faces are preferred over the original slightly asymmetric versions, (Little & Jones, 2003; Perrett et al., 1999). If there is a cognitive preference for faces that are closest to a stored representation then the original asymmetric face would most closely match this and thus should be preferred.

A simpler cognitive explanation for a preference for symmetry is that a symmetrical object requires less effort to process because both halves are similar compared to an asymmetrical object where more processing must occur due to differences that emerge across both halves. In their study, Little & Jones (2003) asked participants to state their preference for a face which was presented in its natural form and a symmetrically corrected version. As mentioned previously, a preference for the more symmetrical version was preferred, however when the same paired face images were viewed inverted no such preference emerged for the highly symmetric version, despite containing all the same information and symmetry as in the upright version.
Little & Jones contended that ease of processing may therefore not adequately explain a preference for symmetry but that the relevance of the stimulus also plays a role where the upright face is more likely a relevant stimulus for judgements of attractiveness and mate choice.

A populist account of how these preferences emerge is usually due to a build up of cultural norms or media exposure. However the most surprising element of these preferences is how early they seem to appear, indicating that they may not be as a result of cultural or media influence. Langlois (1987) demonstrated that infants as young as 2-3 months old demonstrated a preference for looking at (previously rated) attractive faces when paired with unattractive faces. The results were replicated across different cultures suggesting that such preferences pre-exist major socialisation or cultural influences (Langlois et al., 1991). Strauss (1979) showed adults and young infants simple drawings of faces, each of which had a unique set of dimensions across various features, e.g. distance between eyes. Following exposure to these faces, Strauss then showed a previously unseen averaged version of the face images and found that both adults and young infants treated the unseen averaged face as familiar. To account for this preference he proposed that both younger and older participants had built an average representation of the observed faces in memory. To test this with more naturalistic stimuli, Rubenstein, Kalakanis & Langlois (1999) used real face images and found that averaged faces attracted significantly longer looking times than the individual faces. Similar to the Strauss study they also found that infants would treated previously unseen average faces as familiar following exposure to their constituent face images. Rubenstein et al. suggested that infants are able to begin prototyping from shortly after birth with exposure to as little
1.0 General Introduction

as 32 faces and that such a number of faces, when averaged, will very closely approximate the population mean of any 32 faces. Other studies have demonstrated that this ability in young infants is not limited to faces but also other types of visual stimuli (Bomba & Siqueland, 1983).

Although some of these findings have been replicated with infants between 3-6 months, deHaan, Johnson & Perett (2000) could not find evidence of prototyping in infants 1 month and younger. This suggests that at least some preferences for average stimuli are not innate and arise as a result of experience.

1.2.2 Dynamic Displays

Despite the abundance of information gathered from this research, these and many other studies in the area lack a fundamental element of face perception, namely face motion. Dynamic displays of faces contain information such as sex of the person, health, emotional state and other important qualities. While gender is usually obvious from looking at a static face image, the type of movements displayed by male or female faces differs in terms of attractiveness perception. In a study examining dynamic faces and attractiveness, Morrison et al. (2007) showed that participants could identify the gender of a face through movement alone when traditional face shape cues were removed and applied to a digital model. Furthermore they found that the ability to easily identify gender was positively associated with attractiveness particularly in the case of female faces. Female faces were found to move more than males and displayed more frequent behaviours such as blinking, nodding, shaking etc. Such feminine movements were found to enhance the attractiveness of the face.
One of the most salient pieces of information communicated by the face is expression. Many social interactions involve some form of emotional expression, (Eckman, 2003), however, not all emotional expressions carry information relevant for judging attractiveness. Perhaps the most obvious expression we think of when judging attractiveness is smiling. Happy and smiling expressions are known to communicate friendliness, mutual interest, trust and approachability; factors that are often associated with attractiveness (Becker et al., 2007). However, the information presented by smiling may be processed differently depending on whether the perceiver is male or female. Tracy & Beal (2011) carried out a study examining the effects of different types of emotional expression and how they might affect attractiveness. Specifically they tested how these expressions may differ in their effect depending on the sex of the perceiver. They tested happy, proud, shameful and neutral expressions which are known to be recognised cross culturally (Ekman, 1971; Izard, 1971). Of the expressions tested, happiness or smiling was found to be the most attractive expression for a female face but one of the least attractive for a male face. Pride was found to be the most attractive expression for a male face but one of the least attractive for female faces, and shame expressions were found to relatively attractive for both sexes with females rating male shame expressions as more attractive than smiling. Tracy & Beal suggested adaptive evolutionary reasons for observing these differences. For example, the most attractive male expression, in this case pride, is thought to communicate a male’s higher status and ability to provide thus making them a more attractive proposition. On the other hand they contended that men have evolved to look for females who were better able to have and raise children, rather than provide for them, therefore making an expression of pride a less
1.0 General Introduction

Attractive expression in female faces. The result for the attractiveness of shame in both sexes is also thought to have evolutionary roots. Shame is thought to signal a number of things including lower status or submission, explaining its attractiveness in female faces, but it also signals trustworthiness or commitment to social norms and group systems making it a relatively attractive expression for male faces.

1.3 Perceived Attractiveness of bodies

The above studies regarding visual face perception represent some of the most salient and well documented features in the understanding of attractiveness. Despite the richness of information contained and communicated by the face, perception of this information requires proximity to a person. The body, however, can convey information relevant for attractiveness to the perceiver at a much greater distance. Johnson & Tassinary (2005) found that people were able to accurately judge the sex of a walker based on the movement of the waist and hip regions. Troje, Westhoff & Lavrov (2005) demonstrated that a person can be identified by the way that they move even where the visual angle on the retina is relatively small. Provost, Quinsey & Troje (2007) further demonstrated that not only could a person’s gait be used to judge attractiveness but that even gait changes across the menstrual cycle in women lead to differing evaluations of attractiveness by males.

Similar to the face, the body can convey information such as sex, age, health and reveal any asymmetries at a glance. Of the information available, distribution of body fat, either through body mass index (BMI) or more specifically the waist to hip ratio (WHR) or waist to chest ratio (WCR) are the most commonly studied features. For males judging females a WHR of around 0.7 was preferred (i.e., smaller waist width
relative to hip width) when rating pictures of female figures (Singh & Luis, 1995), this was also found to be consistent across differing cultures (Thornhill & Grammer, 1999). For females judging males a WHR of around 0.9 to 0.95 was preferred (Furnham et al. 2001, Singh 1995). However, other studies have suggested that WCR was more important when rating male figures for attractiveness than their WHR. Maisey et al. (1999) found that a WCR or ‘inverted triangle’ where the chest/shoulders were wider than the waist was found to be the best predictor of attractiveness in males. Preferences for WHR or WCR are both thought to stem from evolutionary roots where a low WHR is indicative of reproductive health and that the female is not already pregnant, likewise a WCR indicating upper body strength suggesting dominance and masculinity in the male. In spite of the overwhelming support for WHR as a major predictor of attractiveness some evidence suggests that overall body fat is the better predictor. In their study Cornelissen et al. (2009) asked groups of observers to rate body shapes for attractiveness, WHR and body fat and recorded their eye movements to see where they looked when making those decisions. They found that when rating attractiveness eye movements tended to be focused on the central abdomen and chest area and not on the hips or pelvic areas as would be expected were WHR being used as an indicator. Eye movement patterns when rating body fat were found to be similar to those made when judging attractiveness. Only when specifically asked to rate WHR did observers eye movements focus on the hips and waist area. Other studies have also supported that the incorporation of information from the torso region in general, comprising BMI, WHR and WCR, was the best indicator of overall attractiveness and that this is consistent across race and ethnicity, (Donohoe et al., 2009; Richmond et al., 2012).
Concerning the question of what exactly about the body shape is being extracted in attractiveness assessments, Karremans et al. (2010) demonstrated that congenitally blind men preferred a low WHR when assessing stimuli using only touch. The authors suggest that visual input of this information only serves to reinforce already existing preferences and may not be a preference developed as a result of visual media as some studies have suggested (Harrison, 2003; Orgel, Uria & Swedlund, 2005).

Many studies concerning body proportions and attractiveness rely on static images; however, it is clear that much like the face, a body in motion contains further information for judging attractiveness. In his pioneering work on point light displays Johansson (1973, 1976) demonstrated that just a few moving points to indicate the major features and joints of the human body could convey enough information to be perceived as a body in motion even in very short exposure times. Other studies since have shown that is also possible to perceive age, gender, health, emotional state, intention, and even things like the identity or even sexual orientation of the person through simple low information displays (Dittrich et al., 1996; Johnson et al., 2011, Johnson et al., 2007; Troje et al., 2005).

1.4 Face and Body

Although face and bodies both contribute information for judging attractiveness, much of this research has examined these aspects in isolation. This raises the question of whether their independent contributions easily generalise to real world perception of attractiveness. From an evolutionary perspective faces and bodies have almost always been encountered simultaneously and it is only in the relatively recent past
that we have been more likely to encounter only body or face images in isolation, for example, images of a model's face on a billboard or magazine. It is therefore logical that our preferences may involve some form of interaction between a face and body when making an assessment of attractiveness. Despite a sparseness in the literature for examining the two together, a number of studies have shed some light on this question. Thornhill & Grammar (1999) demonstrated that independent ratings of attractiveness for various body and face types correlated highly with each other and suggested that both function together to provide a single unified trait on which attractiveness judgements are made. Alicke et al. (1986) matched different sets of faces to different bodies in three levels of attractiveness (low, medium, high) and had participants rate these images for overall attractiveness. They found overall ratings were at their highest when highly attractive faces were matched with highly attractive bodies. More interestingly however was the difference in some of the other combinations. A highly attractive face matched with a low attractiveness body had a considerably lower overall rating than a relatively unattractive face that was matched with a high attractiveness body. Their results suggested that although there may be some form of interaction when perceiving face/body attractiveness, bodies may be of higher importance when judging attractiveness. Currie & Little (2009) also sought to examine this relationship further by determining the relative contributions of the body and face to overall relationship attractiveness. In their study participants viewed images of bodies and faces separately, followed by the combined body and face images. They were asked to rate images for their attractiveness for both a long term and short term relationship. The authors found that faces were the best predictor of overall attractiveness for both long and short term relationships. However the results
varied for male and female participants with male participants placing a higher value on body attractiveness when it came to short term relationships. No such difference was observed for female participants.

Other studies however suggest faces and bodies contribute to attractiveness independently of each other. Peters et al. (2007) determined that while face and body attractiveness were both correlated with overall attractiveness, there was no significant interaction or correlation between them. In line with previous research they found that faces were the better predictor for attractiveness and proposed this may be due to the prominence of facial features such as emotional expression and speech, or as a way of determining mutual interest via gaze direction.

1.5 The voice as an Auditory ‘Face’

While visual information may play a large role in our perception of attractiveness in others it is by no means the only signal we use. Exposure to voice information about others is commonplace through things like telephony and radio where we are easily able to make judgments of attractiveness. Belin et al. (2011) described the voice as an ‘auditory face’ conveying much the same information found in vision such as age, gender, body size, biological condition, etc. Borkowska & Palowski (2011) demonstrated that voice pitch can be associated with attractiveness. Their study revealed that ratings of attractiveness increased for females as voice pitch increased but that this relationship was not linear. Increasing pitch was associated with femininity but beyond 280Hz female voices were considered to be ‘babyish’ or sexually immature. Feinberg et al. (2008) showed a similar result for male voices.
where more masculine voices were considered more attractive by females. Borkowska & Palowski further demonstrated a relationship between voice pitch and dominance where ratings of dominance increased with lower pitched voices. Dominance has been shown to be a contributor in male attractiveness (Cunningham et al., 1990). Interestingly, deliberate manipulation by a speaker to make his or her voice more attractive by exaggerating sex typical traits (increasing pitch in females, decreasing pitch in males) does not appear to enhance attractiveness. However deliberately exaggerating atypical voice traits (decreasing pitch in females, increasing pitch in males) may in fact decrease attractiveness (Fracarro et al., 2012).

In much the same way that averaging faces has shown to be more attractive than individual composite faces, advances in speech processing have allowed researchers to create average voices. Bruckert et al. (2010) found that adding voices and morphing them to create a new composite one resulted in a more attractive version than any of its constituent, or individual voices. This was found to be the case for both male and female voices. They suggest that the reasons for this may be similar to average faces where distinctive artefacts and irregularities are reduced producing a smoother voice texture.

Auditory information that is not directly associated with a person has also been shown to influence perception of attractiveness. Exposure to non-verbal auditory sounds is unavoidable; in particular music pervades daily life from work life to home life. May & Hamilton (1980) found that positive-affect rock music could positively increase ratings of attractiveness of men by women when compared with negative-affect avant-garde music or silence.
1.6 Other Perceptual Sources

While much of the research surrounding attractiveness concentrates predominantly on sound and vision a growing body of literature has highlighted some of the other modalities involved in our perception of others.

Interestingly olfactory information has been found to be rated as a highly important piece of information when judging attractiveness. Herz & Cahill (1997) demonstrated that men were found to rate both the visual and olfactory senses as being equal when choosing a potential mate and smell was one of the most likely features to negatively affect that decision. This result was supported by Havlicek et al. (2008) who also demonstrated that smell was more arousing for females than males and that some cultures differed on the relative emphasis for visual and olfactory input, with Czech participants rating body odours more positively and being less visually oriented than their American counterparts.

Dematte et al. (2007) reported that olfactory cues could specifically influence ratings of facial attractiveness. In their study they asked female participants to view a series of male faces which were accompanied by pleasant or unpleasant smells via an olfactometer. They found that male faces accompanied by unpleasant odours were rated as significantly less attractive than male faces accompanied by pleasant odours or clean air. Further to this they also showed that the type of smell, either body relevant (aftershave, body odour) or not body relevant (rubber, flowers), did not affect the results.
Similar to vision and audition, Rikowski & Grammer (1999) sought to examine whether a person's scent could be a signal of mate quality. They asked some of their participants to wear a t-shirt for three consecutive nights after which the t-shirts were presented to opposite sex raters. Half of the raters judged only the odour of the t-shirt while the other half judged photos of the t-shirt wearers. The authors found a significant positive correlation between facial attractiveness and attractiveness of the body odour indicating that scent may be providing similar signals to mate quality as face or voice.

Sense of touch has also been shown to have an influence on our perception of others. In a simple experiment, Williams & Bargh (2008) demonstrated that feelings of interpersonal warmth could be manipulated by having the participant hold a cup of hot or cold liquid. Participants judged a target person as having 'warmer' personality traits if they held the hot liquid and the reverse was found for the cold liquid.

1.7 Chemistry

Underlying many of these non-visual perceptual sources as well as almost every facet of physical attractiveness is a fundamental chemical difference between men and women, namely the hormones testosterone and oestrogen. No discussion of attractiveness would be complete without at least some mention of how males and females differ not only in their appearance but also in their perceptions based on their testosterone to oestrogen ratios.

Widespread throughout the animal kingdom, and including humans, is the effect of testosterone levels on male attractiveness and their competition for attracting mates.
Testosterone is recognised to affect a number of facial features that are also known to contribute to positive judgments of attractiveness. Increased testosterone levels are associated with a broadening of cheekbones, protrusion of eyebrow ridges and a lengthening of lower facial bones, all of which contribute to a masculinized face. Oddly, however, higher levels of testosterone that contribute to such masculine features are also known to suppress the immune system in humans as well as many other male animals (Boje et al., 2012; Saino, Møller & Bolzerna, 1994). This however may have a beneficial trade-off by displaying a particular male’s ability to cope with this biological stress on their body and thus signal higher quality genes (Fink & Penton-Voak, 2002).

Likewise in females, a higher oestrogen level enhances facial features associated with attractiveness (e.g. prominent cheek bones) but also has a similar effect whereby higher levels of oestrogen can also negatively impact on the immune system. Again this is thought to have the trade-off of being a positive signal of an ability to cope with such biological stress. Higher levels of oestrogen can also be detected by smoother skin and the absence or lower presence of facial and body hair with such features having been found to be almost universally associated with higher ratings of attractiveness (Fink, Grammer & Thornhill, 2001). Though the presence of increased body or facial hair in males may enhance their masculinity and subsequent attractiveness not all studies agree that the more masculine a face the more attractive it is perceived to be. Perrett et al. (1998) demonstrated that male faces with exaggerated or highly masculine features were perceived to be less attractive owing to the fact that they were perceived as being more dominant, less warm and
less honest than more feminized male faces. Indeed a number of studies have associated high levels of testosterone as being responsible for higher levels of aggression and other socially undesirable behaviours in males (Björkqvist, 1994; Olweus, Mattsson & Schalling, 1980).

In females the influence of the menstrual cycle has garnered much attention and generated many studies that have demonstrated the changing preferences in attractiveness perception across the cycle. Johnston et al. (2001) showed that a female’s preference for a more masculine face was higher during the point of their menstrual cycle where there was a higher chance of conception. They also demonstrated that females who were already in relationships exhibited larger shifts in preferences during their menstrual cycle than females who were not. Johnston et al. proposed that these changes are as a result of adaptive trade-offs in mate preference. During periods of low likelihood for conception females are more likely to prefer more feminized male faces which are associated with higher levels of things like sociability and thus a higher likelihood of that male to invest effort in an offspring. However when a female’s chance of conception is higher a more masculine face is preferred as it is more likely to result in pregnancy. The neural mechanisms behind generation of positive attitudes towards a potential mate are also thought to be altered by these changing ratios of oestrogen, progesterone and testosterone in the blood stream. This influence of changing levels of hormones in the blood stream may help explain from an evolutionary perspective why some preferences in both males and females are found universally throughout all humans and appear to be highly resistant to cultural influences.
Research has traditionally focused on the physical inputs used to make assessments of attractiveness. However, this does not provide a complete picture. While initial assessments can be quickly made using physical inputs, additional non-physical information presented can influence our perception of that person. In their paper 'What is Good is Beautiful', Gross & Crofton (1977) showed that facial attractiveness ratings could be influenced by information attributed to that face. Participants were presented with a face and a description of that person; faces that were accompanied by favourable descriptions were rated as being more attractive than unfavourable descriptions. Further to this the ratings also differed from their pre-rated scores where a favourable description further increased the rating of attractiveness for a face and vice versa for an unfavourable description. Similarly Nisbett & Wilson (1977) found that ratings of overall appeal and attractiveness could be influenced when the target person presented themselves with either a warm or cold personality. In their study they had students rate an instructor who appeared warm and encouraging towards the students and their work or who appeared cold and dismissive of the students' capabilities. Students who saw the instructor with the warm personality rated them more positively on a number of attributes including physical appearance. In fact it may not even be a requirement that a person possesses a warm personality but simply being available has been shown to influence perception of attractiveness. Gladue & Delaney (1990) demonstrated that attractiveness ratings for opposite sex patrons of a bar increased the closer it was to closing time, suggesting this may be due to relative availability of potential opposite sex mates. Interestingly the authors
1.0 General Introduction

noted that these ratings were not influenced by increasing levels of alcohol as the evening progressed.

1.9 Time and Timing

As well as judging faces or voices for attractiveness we naturally make other judgements concerning social qualities of that person that also affect our overall evaluation of that person. In the 1940's Solomon Asch wrote that with great rapidity first impressions such as "A glance or a few spoken words are sufficient to tell us a story about highly complex matter" and although such impressions may be confirmed or altered over time it is impossible not to make such quick judgements. In terms of attractiveness a very brief exposure is enough to determine how symmetrical or average a face is. Willis & Todorov (2006) demonstrated that ratings of attractiveness for an unfamiliar face, where the exposure was only 100ms, correlated highly with ratings for attractiveness where no time constraint was present and that confidence in these judgements became higher with the increased exposure time. Willis & Todorov also demonstrated that judgements relating to a person's character could also be made in a very short amount of time based solely on their appearance and also remain very strong over time. The authors also measured ratings for traits including likeability, competence, trustworthiness and aggression. Similar to attractiveness ratings they found that judgements made after only a 100ms exposure to the face image correlated highly with judgements made in the absence of any time constraint. The authors also expected to find the highest correlation between attractiveness in the time constrained with time unconstrained judgements because attractiveness is a physical property of the face, however the correlation between
1.0 General Introduction

trustworthiness in the time constrained and time unconstrained judgements was actually higher. They suggest the reason for this was that detection of trustworthiness was essential for ancestral survival and may be associated with automatic activity in the amygdala where dangers or threats are processed. This is in line with other research in the area which have highlighted dedicated neural and cognitive mechanisms specialised to ensure survival (Cosmides & Tooby, 1992; Winston et al., 2002). Willis & Todorov concluded that inferring traits based on the facial appearance of another person may be fast, automatic and effortless.

Although it is difficult to identify the exact feature or combination of features that are informing these inferences one of the quickest and easiest features occurring in a face is that of eye movements and, of most relevance to attractiveness, that of gaze direction. Direct eye contact is thought to be one of the most important factors in capturing attention and effective social communication (Emery, 2000). It has also been shown to be not only important cross culturally but also important for communication in non-primates (Argyle & Cook, 1976; Linnankoski et al., 1993). Here, however, gaze aversion studies may offer the most information relevant for judging attractiveness. Larsen & Shackelford (1996) examined two major areas of gaze avoidance research, personality or psychopathology correlates of those who tend to avoid eye contact and social judgements made about those who avoid others’ gaze. The authors highlighted that those who avoid gaze are more likely to possess unattractive traits such as shyness and social anxiety, are at a higher risk of developmental problems and are less likely to emerge in positions of power. More importantly for attractiveness, however, were personality or social judgements made about those who avoid eye contact which found that such people were perceived to
be more anxious, stressed, deceptive and less dominant. The degree to which these social judgements were affected differed by sex. Gaze avoidant females were rated more negatively on levels of intelligence, happiness, sincerity and attractiveness than males.

Although studies such as those carried out by Todorov and colleagues (Todorov et al, 2005; Todorov, Pakrashi & Oosterhof, 2009) show that inferences about a person are crucial in how the person is evaluated as a whole, these studies are often based on the very short term evaluation of strangers, thus failing to match the more natural experience of knowing a person over time. Kniffin & Wilson (2004) attempted to address these problems by conducting a series of studies that more accurately reflected real life experience. In the first study participants rated photographs from their own year book for attractiveness and a number of non-physical traits and the same photographs were also rated for attractiveness by a group of strangers. They found that ratings of physical attractiveness were not based purely on physical features but were highly influenced by knowledge of a person's non-physical characteristics. To further investigate this the authors conducted another study where participants unfamiliar with each other, rated each other before and after working together over a six week period. The results showed that ratings of attractiveness for the same person could be modified over time as participants got to know each other. Participants who were deemed attractive before working together but who displayed unlikable characteristics, such as poor work ethic, were shown to be rated as less physically attractive after the study whereas participants who were rated as unattractive at the beginning of the study but who showed likable characteristics were rated significantly higher at the end of the study. While Todorov
demonstrated that participants' inferences about a person were highly stable from very short to unlimited exposure durations, the experimental setting and the static stimulus means that it is unlikely that participants chose to spend more than a few seconds in the unconstrained conditions actually looking at and evaluating the person. This may help to explain why Kniffin & Wilson (2004) found that perceptions of attractiveness and other traits did in fact appear to change over the course of time both positively and negatively.

One explanation for this difference is offered by the mere exposure effect (MEE) Zajonc (1968). The MEE refers to a process whereby increasing familiarity with a stimulus increases the liking for that same stimulus. In his original study Zajonc exposed participants to faces at differing levels of exposure frequency, 1, 5, 10 or 25 times. Faces that were seen more frequently were subsequently rated as being more likeable with the most frequently seen being rated as most likable. Since then the MEE has been replicated many times within the domain of attractiveness (Peskin & Newell, 2004), as well as other domains such as advertising (Fang, Singh & Ahluwalia, 2007).

1.10 Neural Processes

With all the incoming information available for judging attractiveness and its seeming importance from an evolutionary point of view and mate choice it is essential to look at any underlying brain processes or structures that may mediate this decision. Although a great deal of research has been done in neuroscience to understand how faces and bodies are processed, most of this has focused on recognition of identity or
1.0 General Introduction

emotional expression and it can be difficult to obtain specifics relating to attractiveness. Not surprisingly a number of distinct regions appear to be involved depending on the exact nature of the stimulus. Evidence suggests that differing activations occur if a face is judged from a purely aesthetic point of view or if it is judged to be rewarding in terms of a potential mate choice. Aharon et al. (2001) found that males viewing attractive faces, either male or female, exhibited activation in areas such as the orbito frontal cortex and nucleus accumbens. However additional activation was observed in response to attractive female faces where male subjects were found to expend more effort in order to increase exposure to those faces. The authors suggest there is a distinct dissociation between aesthetic and reward responses when viewing attractive faces. O'Doherty et al (2003) and Cloutier et al. (2008) also showed dissociated regions when it came to processing attractive or unattractive faces with attractive faces activating medial orbito frontal cortex and unattractive faces activating more lateral regions.

As outlined above certain trait inferences appear to be done with great speed suggesting an automatic underlying process. Studies have shown increased activation in the amygdala when a face was deemed to be untrustworthy (Engell et al., 2007; Winston et al., 2002). Adolphs et al. (1998) showed impairment of this process in patients with amygdala damage. These patients were seen to give increased trustworthiness ratings to faces that were otherwise deemed as untrustworthy by typical controls, suggesting that the amygdala may be involved in the decision making process for a person's attractiveness.
1.0 General Introduction

1.11 Age & Attractiveness

Nearly all the information and features used to judge attractiveness discussed so far can be linked directly to and affected by the age of the source. Within the domain of research on attractiveness the majority of it is focused primarily on face and body attractiveness or dimorphic differences and often using young stimuli and participants. The contribution of age to both judgements of attractiveness and even changing perceptions of attractiveness across the life span has received sparse attention.

Fink, Grammer & Matts (2006) pointed out that many female body features used for judgements of attractiveness are directly linked to age and reproductive health which in turn are affected by oestrogen to testosterone hormone ratios. Features of attractiveness and femininity in females (e.g. WHR), correspond to relatively high ratios of oestrogen to testosterone and subsequently cues to reproductive health. As these ratios change so too can these features. A higher ratio of oestrogen is known to regulate the distribution of fat primarily distributing it to the buttocks and thighs and inhibiting its build up on the waist and abdominal regions, (Rebuffe-Scrive, 1988). As this ratio lowers with age WHR is also lowered altering signals of reproductive health and attractiveness. A similar mechanism in males, but through testosterone, results in a higher WCR when younger but this too however is subject to change through ageing as are perceptions of the individual.

Unsurprisingly many of the signals or ornaments used to determine or project an individual’s attractiveness are negatively affected by ageing and hormonal changes
1.0 General Introduction

(Fink & Grammer, 2006; Teuscher & Teuscher, 2007). Asymmetries in the face can be increased by changes in elasticity of the skin and underlying muscles. Similarly, asymmetries in posture or motion can also arise as a result of muscle deterioration, an accumulation of injury or onset of conditions such as arthritis. Texture and appearance of the skin can be adversely affected by hormonal change and photo damage which again is likely to accumulate as result of age and increased exposure to ultra violet radiation via sunlight (Boyd et al., 1995; Wlaschek et al., 2001).

Bradshaw, Bubier & Sullivan (1994) showed evidence for consistent preferences for younger female faces between the ages of 15-25 in males regardless of their age or cultural background. Alley (1993) ran a similar study and found that females regardless of their age or cultural background had a preference for males aged between 30-45 years of age, although it was also reported that their preferences were more variable than those of males. This result is often colloquially referred to as the ageing double standard where older women are judged as being less attractive than older men. Although anecdotally many contend these preferences are primarily driven by media and their tendency to use younger females and older males in advertisements, films etc., there may be a simpler biological reason for these preferences rooted in our evolutionary history. As outlined above optimum reproductive health tends to be concentrated in the earlier parts of a females lifespan, thus signals related to this tend to be found as highly attractive. Males, however, continue to be capable of reproduction well beyond early life and into middle and older ages. Similarly older male faces tend to be perceived as being more masculine and dominant and as such convey qualities like reproductive health and
ability to provide which are attractive to female perceivers (Brooks & Kemp, 2001; Hansen & Price, 1995).

1.12 Image Management

Only in the past century or so has it been possible to isolate features such as face, voice or motion to individually and collectively examine their roles in attractiveness judgements. Magazines, radio, television etc. have been able to present highly segmented sources of information which have been utilized to give a broader and deeper understanding of these processes that otherwise may not have been practical up to this point. In the even more recent past, particularly the last decade or so, a new way of presenting information relevant to the presentation and perception of attractiveness has emerged via social media. In order to have the most comprehensive understanding of attractiveness perception it is important to highlight this emerging platform and its contribution to our understanding of the field.

While there may be long established evolutionary preferences, it is difficult to ignore how face and body image information is relayed to us in increasingly diverse and segmented ways. A number of early studies examining the rise of popular visual media noted that there was often a trend for men and women to be framed differently, with men usually being in a closer frame than women, the result being that male faces and female bodies were more likely to be seen, Archer et al., (1978) referred to this as ‘face-ism’ or ‘body-ism’. This trend has also been noted in prime-
time television programmes and advertisements for the last number of decades (Copeland, 1989; Hall & Crum, 1994).

Although these results may no longer seem surprising, the face-ism or body-ism effect appears to have become well established even when it is possible to control images of ourselves and how we are presented.

The use of social media platforms usually requires the user to present information about him or herself and often it is a photograph that is the most prominent feature or first piece of information visible on their profile. Cooley & Reichart-Smith (2010) found that Facebook male users scored higher on the face-ism index, meaning that faces were featured more often in their profile photographs, than female users. The rise of such social platforms has also allowed individuals unprecedented control over how their image is presented to others and has consequently opened a new window into research on attractiveness. The nature of the platform means first impressions are based predominantly on visual appearance, often containing little social information about the profile owner which may otherwise enhance or decrease attractiveness. According to Duck (1982) initial visual cues such as a person’s height, hair colour, race and attractiveness are vitally important for determining whether to continue interacting with that person.

The extent to which these visual cues can be controlled through social platforms such as Facebook has been examined in a number of studies in the past few years. Hum et al. (2011) found that the profile photographs of the user tended to be deliberately and statically posed with the user being the only subject in the photograph. Users also tended to have approximately twenty profile pictures representing themselves
which followed the same pattern. Despite the relative difference in face or body prominence, male and female users followed these same patterns for presenting photographs of themselves. Wang et al. (2010) found that attractiveness of a user’s profile picture had an effect on other users interaction with them. Users were more likely to initiate a friendship with someone who displayed an attractive photo of themselves than a user who presented an unattractive photo. Users were also more likely to initiate friendships with others who displayed no photo at all of themselves compared to ones who displayed an unattractive photos. Similar to the Geiselman et al. (1984) study where faces were judged to be more or less attractive depending on the relative attractiveness of the other faces surrounding them, Walther et al. (2008) found a similar pattern for users profile photographs on Facebook where users whose friends profile photos were deemed to be attractive significantly enhanced the perceived attractiveness of the original profile owner.

1.13 Limitations of existing research

As demonstrated by this review, the study of attractiveness has gained a large amount of attention and is quite diverse in its approaches. It has been quick in adapting to accommodate the way attractiveness judgements can be made as seen by new research on various media platforms. While unisensory perception of attractiveness is relatively well understood, particularly within the visual modality, its ecological validity may be of limited use. Our interactions with others are usually multisensory in fashion, in particular that of seeing someone’s face and hearing someone’s voice. Although there exists a small but growing body of literature concerning multisensory attractiveness perception there remain large gaps that need
1.0 General Introduction

to be studied in greater detail in order to give the same type of understanding that we have for unisensory attractiveness perception. One such way of gaining a greater ecologically valid understanding of attractiveness is to examine features that are found across the senses such as face and voice. It is the aim this thesis to contribute to attractiveness perception by examining how both face and voice information are evaluated.

There also exists gaps in the literature pertaining to the cognitive mechanisms with which we build up preferences for individuals over a period of time. Although much work has been done highlighting role of MEE in enhancing liking for others, relatively little work has been done to explore the limits and robustness of this effect outside the strict paradigm of the original studies. Another such gap can be found in the relatively unexplored effect of ageing on attractiveness. While there does exist a body of work on the subject much of the work done tends to focus on general preferences and in particular changes in female attractiveness across the lifespan. Broader questions need to be addressed such as the role of sensory and social information in evaluations by older adults when making judgements of attractiveness or if accrued experience through major life events such as having children, marriage, work etc. lead to the development of different preferences than their less experienced younger counterparts.

1.14 Project Background

The experiments reported here were conducted to address some of the wider objectives of the ‘Captavatar’ project. The past decade or so has seen a vast increase in the level of human computer interactions. In particular advances in computing
have made it commercially practical to create lifelike virtual agents which we are now routinely exposed to in forms such as gaming and entertainment, however, very few of these efforts at creating lifelike virtual agents have attempted to make them appeal in the long term. Currently, industry lacks a comprehensive understanding from areas such as social neuroscience as to how to increase social realism and engagement, which are crucial in order to create improved versions of these virtual agents.

It has been established that the more engaging an educator or a health professional is with their target audience, the better the outcome for the individual (Alborz et al., 2009; Giangreco et al., 2001; Stewart, 1995). One of the main goals of the Captavatar project is to establish the principles which underlie our preferences for others, particularly visual and vocal information, and to use this to inform the creation of realistic virtual humans which are both appealing and engaging to interact it. These virtual humans will be used in practical applications such as gaming, health and educational interventions.

One way in which to achieve this goal is through the study of attractiveness, which by and large forms the initial basis for all friendships and relationship. Understanding the mechanisms and information by which people make judgements of attractiveness and by testing these across individuals at different stages of development will better inform how to create realistic and engaging virtual humans fit for the practical applications aspired to by the Captavatar project.

1.15 Outline of thesis
1.0 General Introduction

The following section outlines the main aims of experiments in Chapters 2 to 6 in this thesis.

1.15.1 The role of simultaneously presented cross sensory social information

Chapter 2 sought to investigate whether or not ratings of attractiveness for faces could be influenced by the semantic information contained in accompanying speech. Specifically this chapter aimed to examine the role of humour in the evaluation of attractiveness for male and female faces. Pictures of faces were presented with accompanying speech that contained either humorous or non-humorous content and compared to each other as well as a picture-only condition to assess humour's relative impact.

1.15.2 The role of frequency of exposure in attractiveness judgements

Chapter 3 sought to probe the limits of the mere exposure effect (MEE) (Zajonc, 1968). This effect describes the process whereby a stimulus such as a face is evaluated more positively the more frequently it is seen. The series of experiments described in this chapter aimed to investigate the role of emotional expression on the MEE as well as whether or not the effect is image or person based. Finally the experimental paradigm of MEE was manipulated to see whether proportional frequency or the nature of presentation of stimulus influenced the MEE.

1.15.3 Ageing and evaluation of faces and voices
Chapters 4, 5 and 6 describe experiments that were conducted to investigate the role of ageing on evaluations of the attractiveness. The vast majority of research concerning attractiveness as well as trait evaluation has been conducted using young adult participants and stimuli. However little effort has been made to understand whether these perceptions remain stable as a function of the age of the participant or the stimulus. In these chapters I conducted a series of experiments asking participants of different age groups to evaluate faces and voices of different age groups for attractiveness as well as a number of other trait dimensions. I also investigated whether or not older and younger adults attended to faces differently when rating them for attractiveness through the use of eye tracking techniques.
2.0 The role of simultaneously presented cross-sensory social information on judgments of attractiveness

**Abstract**

Humour is often listed as one of the most desirable traits in a partner (Davis, 1990). However the exact relationship between humour and attractiveness is poorly understood. Studies examining this relationship have demonstrated divergent results with some studies indicating an overall positive effect of humour on attractiveness but others demonstrating that a display of humour can lead to negative evaluations of a person. Furthermore the majority of these studies have relied on simplistic stimuli and ways of demonstrating a persons' ability to produce humour. Here we investigated whether or not the attractiveness of an individual could be influenced by vocal information provided during exposure to the face image. We found that faces associated with humorous vocal information were rated as being significantly more attractive than faces associated with non-humorous vocal information. However the study failed to find any difference between faces associated with humour and faces that were seen with no vocal information.

2.1 Introduction

Author E.B White (1941) said of the study of humour that "analysing humour is like dissecting a frog. Few people are interested and the frog dies of it". However a number of studies have shown that sense of humour is ranked highly among desirable traits for potential romantic partners (Lippa, 2007), and is generally associated with other positive personal qualities (Cann & Calhoun, 2001). In the beginning stages of a
2.0 The role of simultaneously presented cross-sensory social information on judgments of attractiveness

Gueguen (2010) found that men who displayed humour were more likely to be successful at getting a potential partners' phone number. Davis (1990) found that sense of humour in a potential partner featured prominently in personal ads of both men and women occurring in around 17% of personal ads posted by men and around 23% of ads posted by women. Across cultures relationship satisfaction has been found to positively correlated with a partner's sense of humour and their ability to make the other laugh (Weisfeld et al., 2001).

Despite its seeming prominence as a factor in the selection of partners and formation of relationships, humour has attracted a relatively small amount of interest in relation to its role in attractiveness perception. In part, this may be due to a lack of agreement on how and why humour has emerged to become such a prominent aspect in our choice of mate and daily social interactions.

Whereas preferences for other traits such as trustworthiness and signals of attractiveness have found explanation in terms of adaptive evolutionary functions, for example, a symmetrical face signalling good health (Rhodes, 2006), humour has no such agreed upon adaptive function. Despite this, vast amounts of time and energy are expended on creating and appreciating humour in daily life, it is thought to be universal and appears to be specific to humans (Howe, 2002; Polimeni & Reiss, 2006).

Several theories have emerged to explain the importance of humour in human behaviour covering a wide spread of ideas, often with little overlap with each other. For example, a number of benefits have been suggested for the evolution of humour in humans with some theories suggesting that humour evolved to facilitate social interaction and hierarchies by enhancing feelings of camaraderie among a group
The role of simultaneously presented cross-sensory social information on judgments of attractiveness (McGhee, 1983; Wiesfeld, 1993;) and elevating the speaker or lowering the status of another who was the target of the humour (Barret, Dunbar & Lycett, 2002). These theories fail, however, to address the non-adaptive features of humour or laughing which are the relatively large expenditure of physiological energy and the fact that laughing is noisy and could potentially attract predators (Weisfeld, 1993).

The role of laughter, which is associated with humour, is itself a matter of much debate. Although Darwin (1872) suggested that laughter from tickling or humour share a common underlying mechanism, laughter itself can be elicited simply as a physical response to a stimulus such as tickling and not necessarily require any cognitive component that is found in the telling and understanding of a joke (Polomeni & Reiss, 2006). Therefore, laughter cannot necessarily be considered as an objective measurable evaluation of humour.

A better examination of the importance of humour is perhaps by measuring its association with intelligence which has received a much greater level of attention. Intelligence has been shown to be an attractive trait for both sexes (Buss, 1989), and has been shown to be highly correlated with physical attractiveness, (Langlois et al., 2000), and long term health (Gottfredson & Deary, 2004). Greengross & Miller (2011) suggested that a sense of humour was sexually attractive to both sexes because it may demonstrate higher intelligence and greater ability to think creatively. They examined whether or not intelligence was correlated with a sense of humour and also with mating success. They measured male and female participants' abstract reasoning ability, verbal intelligence and mating success using standardised measures. They also measured the participants' ability to produce humour by asking
2.0 The role of simultaneously presented cross-sensory social information on judgments of attractiveness

them to create captions for cartoons which were later rated for how humorous they were. They found that intelligence, as measured by the abstract reasoning and verbal ability measures, did in fact predict the ability to produce humour which also predicted mating success measured in number of sexual partners during the participant's lifetime. Furthermore they found that males showed higher overall humour production ability, suggesting that humour may have evolved as a sexually selected trait.

Bressler, Martin & Balshine (2005) found that even the definition of a 'good sense of humour' was used differently by males and females. Their study showed that each of the sexes placed different values on a partner's humour production versus their receptivity. Men were found to stress the importance of a female's receptivity to their humour rather than their ability to produce it. Females, however, were found to place importance on both production and receptivity to humour in male partner. Only when assessing females for potential friendship did the importance of humour production in other females become significant. Other studies have shown underlying sex differences in the neural processing of humorous statements with stronger activations in brain areas implicated in emotion processing such as the amygdala, insula and anterior cingulate cortex in females than in males (Kohn et al., 2011). Kohn et al. suggested that this stronger activation allows for more affective processing of humour in female and consequent appreciation. The lower activation of these areas in males diminishes this affective response resulting in lowered ratings of humour as produced by others.
2.0 The role of simultaneously presented cross-sensory social information on judgments of attractiveness

If humour can influence mating success, then those producing humorous statements should be found to be more attractive than non-humorous individuals. Bresler & Balshine (2006) asked participants to rate the desirability of a person whose photograph was presented with a written humorous or non-humorous/neutral autobiographical statement positioned under their photo image. Their results indicated a participant sex bias in the role of humour on perceived attractiveness with only female participants rating male faces associated with humorous statement as a more desirable relationship partners than faces who were associated with non-humorous/neutral statements. However, for both male and female participants, images of faces associated with humorous statements were, in general, rated as less intelligent and less trustworthy than faces associated with the non-humorous/neutral statements. This result was consistent with an earlier study reported by Lundy, Tan & Cunningham (1998), who used a similar method of displaying a face image of a person and simultaneously presenting a humorous a statement alongside the image. They found that humorous individuals, particularly men, were rated as more attractive for a relationship but also perceived to be less intelligent. The same study also found that the influence of humour on attractiveness was effective only if the image of that persons face was previously rated as being physically attractive.

Much of our knowledge of humour and attractiveness has been gained from studies using fairly simplistic stimuli. The majority of the studies outlined above have relied mostly on presenting unisensory information, usually a photo accompanied by a piece of text, to a participant and asking them to make a rating of attractiveness (e.g. Bresler & Balshine, 2006). The content of the text can be derived from different sources including the experimenter or from the person featured in the photograph
who is usually asked to produce neutral or humorous content. Such methods, however, do not provide a particularly accurate representation of that person delivering the statements, as it not only lacks important auditory cues from vocal information but also requires the participant to divide their attention between the humour and the face separately. In order to better understand how humour is perceived in relation to the perceived attractiveness of an individual, it is important to include multisensory information and present it in a way to which it can be attended to more naturally.

This experiment investigated whether perceived attractiveness can be influenced by vocal information provided during exposure to a face image. Specifically this study looked at whether providing an auditory stimulus, which contained a humorous or non-humorous/neutral statement, simultaneously with a face image affected the perceived attractiveness of that face. Each face image was associated with either humorous or non-humorous spoken statements or with a silent (no voice) condition. The experiment contained an exposure block where faces were presented with their associated vocal condition (or silence), which was then followed by a rating block where each face was again presented again but without sound. Participants were required to rate each face for attractiveness in the rating block. The hypothesis was that attractiveness ratings of faces would depend on the type of auditory information with which they were previously associated.

2.2 Method

Participants
2.0 The role of simultaneously presented cross-sensory social information on judgments of attractiveness

A sample of 57 participants (36 female, 21 male) were recruited from amongst attendees at a public exhibition entitled “Happy” which was hosted by the Science Gallery at Trinity College Dublin. Their ages ranged from 16 to 63 years, with a mean age of 30.3 years (SD = 11.4). Approval for the experiment was obtained from the School of Psychology Research Ethics Committee.

Stimuli

Vocal statements: I initially obtained 76 statements directly from Eric Bresler who used these statements in a previous study (Bresler & Balshine, 2006). These statements included 18 humorous and 58 non-humorous sentences. For the purposes of our study, I selected sentences from this larger set so that all were of approximately the same word count and vocal length and were not culturally specific to North America, where the original study was conducted. From this larger set, 30 statements were chosen and included 12 humorous and 18 non-humorous sentences. Six additional humorous statements were taken from the body of work of comedian and author Woody Allen. The final list of verbal statements used as stimuli can found in Appendix A.

Auditory stimuli were created by recording the statements spoken by six male and six female actors. Twelve actors were recorded in order to be able to later select two males and two females whose voices were considered to be equally attractive so as to avoid biasing participant responses. In total 36 statements were recorded by each actor, eighteen were humorous statements and eighteen were non-humorous. Statements were recorded using a Rode directional microphone in a low noise
environment using soft walls to minimize background noise and reverberation. The recordings were edited using Audacity recording software on a PC.

Face images: The visual stimuli used in this experiment consisted of a set of face images obtained from the Nijmegen Radboud face database. Frontal face images of nine male and nine female models were used. Each model was shown with a neutral facial expression and with a forward facing gaze. Face images were edited to remove external features such as hair and ears. Each face image was contained within an all-black background frame measuring 1024 x 681 pixels, subtending to a visual angle of approximately 25° vertically and 17° horizontally at a distance of 60cm from the screen. A sample of faces can been found in Figure 2.1.

![Sample images of edited faces used in current study](image)

Figure 2.1: Sample images of edited faces used in current study

Pre-rating Study

Prior to conducting the main experiment a separate group of 35 independent raters recruited from visitors the Science Gallery ‘Happy’ exhibition (13 male, 22 female,
2.0 The role of simultaneously presented cross-sensory social information on judgments of attractiveness

mean age 31.2, SD= 6.3) provided ratings of each of the vocal statements according to how humorous they found the statement to be. Raters used a seven-point scale (1=not funny at all, 7=extremely funny) for their ratings. Each statement was heard once and rated immediately afterward. All twelve actors previously recorded were presented here saying each statement. Overall humorous statements (mean rating of 3.68, SD = .55) were rated as more humorous than non-humorous statements (mean= 1.92, SD=.30), [t=10.94, (p<.0001)]. Reliability among participants was high with a Cronbachs alpha of .86

This same group also rated face images to be used in the main experiment. The purpose of rating the faces was to establish a high, medium and low attractiveness category set of faces for use in the experiment and to control for any variation initial attractiveness may have had. In total 18 face images (9 male, 9 female) were rated. Each rater was presented with each face image once for 3 seconds and immediately after presentation rated the image using a seven-point scale (1= not very attractive, 7=very attractive). From this study the 9 female and 9 male faces were ranked into three relative attractiveness groups each. High attractive female faces had a mean rating of 4.2 (SD=.64), medium attractiveness female faces 3.1 (SD =.29), low attractiveness female faces 2.6 (SD=.07). High attractive male faces had a mean rating of 3.3 (SD=.30), medium attractiveness male faces 2.7 (SD=.23), low attractiveness male faces 2.02 (SD=.28). Overall reliability among raters was high with a Cronbachs alpha of 0.81.

Separately a group of 11 independent raters recruited from the undergraduate population at Trinity College Dublin (7 male, 4 female, mean age 27, SD=3.4) rated
2.0 The role of simultaneously presented cross-sensory social information on judgments of attractiveness

each recorded voice clip for its perceived attractiveness and gender. The purpose of this was to find a set of voices that would be matched for attractiveness and gender information (i.e., masculinity or femininity) so that these vocal features would not influence responses to the face images. In this pre-rating study, participants heard each voice actor say three different statements from the set previously described.

A total of three clips for each voice actor were selected for this rating study, these three clips were taken from the non-humour/neutral statements so as to avoid biasing responses. The same three statements were used for each voice actor. Vocal clips were presented in a random order and following each statement participants rated the voice immediately for attractiveness on a seven-point scale (1=not very attractive, 7=very attractive) and to rate it according to how masculine or feminine the male or female voice was respectively (1=very feminine, 7=very masculine). Each statement was heard twice over the course of the rating study yielding a total of 72 statements which were rated by each participant.

A series of t-tests were used to compare voices for attractiveness and masculinity/femininity. From this two voices were selected from each sex that did not significantly differ from one another at 95% confidence level in their attractiveness or masculinity/femininity. Overall reliability among participants was high with a Cronbach’s alpha of 0.79.

Apparatus

The experiment was presented on a colour LCD monitor (1,024 x 768px) at 60Hz refresh rate using Presentation software running a 3Ghz PC with 8GB RAM. The vocal clips were presented via a set of Sennheiser 405 Headphones with the sound level
2.0 The role of simultaneously presented cross-sensory social information on judgments of attractiveness

pressure approximately 56dB. Rating responses were recorded via a standard PC keyboard.

Design

The experiment was based on a within subject, fully factorial design with the auditory information of humour, non-humour and silence as the main factors. Three female faces and three male faces were assigned to each vocal condition. Of the three faces in each condition one face was selected from each of the high/medium/low attractiveness rating study so that for each vocal condition there was always high/medium/low attractiveness faces present.

Each face in each auditory condition was presented three times so that, for example, a face in the humorous or non-humorous condition was presented on three separate occasions with a different statement each time. Faces associated with no sound were shown for the average duration of the speech clips used which was approximately 3 seconds. This ensured that all factors were viewed for an equal amount of time. All trials were presented in a random order. Faces and vocal pairings were counterbalanced across participants. The recorded dependent variable was the rating of attractiveness.

Procedure

Participants were briefed on the experiment protocol and provided informed, written consent prior to taking part. Participants were seated in front of the computer monitor at an approximate distance of 60cm. They were provided with on screen instructions about the task. Each trial began with a central fixation cross which was
2.0 The role of simultaneously presented cross-sensory social information on judgments of attractiveness

shown for 500ms. Immediately following this a face image was presented along with a vocal clip except for the ‘silent’ condition. All 18 face images were shown within a single exposure block and were presented in a random order across a total of 54 trials. Each individual face identity was displayed with only one associated auditory factor. Following the exposure block each face was viewed one more time in a rating block for a total of 6 seconds. For each trial in the rating block the participant was required to rate that face for attractiveness. Faces were presented in a random order during the rating block. Participants were instructed to use a scale from 1 – 7 (where 1 was ‘not very attractive’ and 7 was ‘very attractive’). Participants were encouraged to use as much of the scale as possible and to answer as quickly and accurately as possible. The experiment lasted approximately 8-10 minutes for each participant. Participants were debriefed on the motivation of the study following testing.

2.3 Results

The mean attractiveness ratings were calculated for each condition and are shown in Figure 2.1. The results were compared using a repeated measures, one-way ANOVA with vocal condition (humorous, neutral or silent) as the main factor. A main effect of vocal condition was found \[F_{(1,56)} = 3.9, p = .022, \eta^2_p = .06\]. A follow up pairwise, Tukey post-hoc analysis revealed significantly higher ratings of attractiveness for faces associated with humorous statements compared to non-humorous statements (\(p<.05\)). No significant differences were found between the ratings of attractiveness to the humorous statements and silent images only, or non-humorous and silent images only (see Figure 2.2).
2.0 The role of simultaneously presented cross-sensory social information on judgments of attractiveness

Figure 2.2: Mean attractiveness ratings for each vocal condition. Faces associated with humorous statements were rated as being more attractive than faces associated with non-humorous statements only. SE bars are shown.

To investigate whether the sex of face had an effect on participant's responses a 3x2 ANOVA was conducted on participant's ratings. A main effect of sex of face was found \( [F(1,56) = 20.34, \ p<.01, \ \eta_p^2 = .26] \), see Figure 2.3. A Tukey post-hoc analysis revealed that female faces were rated as being more attractive than male faces across all three vocal conditions \( (p<.0001) \). No interaction was observed between sex of stimulus and vocal condition.
2.0 The role of simultaneously presented cross-sensory social information on judgments of attractiveness

Finally, to establish if the vocal condition affected ratings differently depending on the relative attractiveness of the face a 3 (vocal condition) x 3 (high, medium, low attractiveness of face) ANOVA was carried out. No interaction for vocal condition and attractiveness of face was observed. A main effect of attractiveness was observed, [$F(2,114) = 164.08, p<.0001, \eta^2_p=.74$], with a Tukey post-hoc analysis showing that high attractiveness faces were significantly more attractive than both medium and low attractiveness faces and that medium attractiveness faces were more attractive than low attractiveness faces ($p<.05$), see Figure 2.4. Faces that were ranked as high, medium and low attractiveness in the current experiment corresponded to the same faces ranked as high, medium and low attractiveness in the previous rating study.
2.0 The role of simultaneously presented cross-sensory social information on judgments of attractiveness

**Figure 2.4:** Mean attractiveness rating for faces that were high/medium/low attractiveness. No interaction between attractiveness of face and vocal condition was observed. Consistent with a previous rating study faces were rated. SE bars are shown.

Finally to examine whether the sex of the participant affected responses, a mixed ANOVA was conducted with vocal condition (3) as the within-subject factor and sex of participant (2) as the between subject factor. No main effect of group was observed \( [F(1.55) = .001, p = .98] \), indicating that the sex of the participant did not affect how they responded (See Figure 2.5). There were no significant interactions between any of the factors.
2.0 The role of simultaneously presented cross-sensory social information on judgments of attractiveness

![Graph showing mean attractiveness rating for each vocal condition by female and male participants.](image)

**Figure 2.5:** Mean attractiveness rating for each vocal condition by female and male participants. No significant difference between female and male participants was observed. SE bars are shown.

2.4 Discussion

The aim of the current experiment was to investigate if the perceived attractiveness of a face can be influenced by auditory information provided during exposure to the face image. The experiment also aimed to present this information in a more naturalistic way compared to other experiments on the subject. Specifically, I looked at whether providing a vocal statement which contained humorous or non-humorous information during exposure to a face image subsequently affected its perceived attractiveness. I found that face images which were previously associated with humorous statements were rated as being more attractive than faces that were associated with non-humorous statements. However, there was no significant difference in ratings of attractiveness between humorous and vision only conditions, and non-humorous and vision only conditions.
2.0 The role of simultaneously presented cross-sensory social information on judgments of attractiveness

The relative increase in the perceived attractiveness of faces previously associated with humorous vocal content is similar to a previous result by Bresler & Balshine (2006) who found that humour had a positive effect on desirability. The current study however differs from the Bresler & Balshine study in a number of ways. Firstly participants here were allowed to freely rate individual faces across different conditions rather than using a two alternative forced choice between faces presented with humorous and non-humorous statements which was present in the Bresler & Balshine study. Secondly the addition of voiced statements rather than text allowed the participant to more naturally integrate visual and vocal information by allowing the participant to attend to the face image more rather than dividing attention between the image and a piece of text. This approach allowed for a more naturalistic investigation of how humour might affect attractiveness. Finally the current study also differed from the Bresler & Balshine study by adding a vision only condition where the participant simply rated the attractiveness of an individual that was not associated with any humorous or non-humorous information. Although there was an observed difference between faces associated with humour and non-humorous statements the lack of significant difference between those conditions and the vision only condition warrants further investigation.

It may be important to consider whether the additional sensory information available in the two auditory conditions could enhance ratings for a face compared with the condition in which only one sensory modality (i.e. the face image) was provided. The results obtained here, based on absolute ratings versus a relative rating system such as a two alternative forced choice (2AFC), may reflect a difference in how faces are evaluated in a broader context. For example, Wieser & Brosch (2012) reviewed how
2.0 The role of simultaneously presented cross-sensory social information on judgments of attractiveness

Faces and voices are perceived throughout different contexts and experimental designs. They established that the perception of a face can be influenced by a variety of factors and not simply the visual information presented in the face. Righart & DeGelder (2008) demonstrated that perception of an emotional expression was influenced by the scene in which it was presented. They asked participants to categorise a facial expression that was embedded in naturalistic scenes that were congruent or incongruent with the emotion displayed on the face, for example, an expression of disgust was congruently paired with a scene depicting a dirty street or incongruently with a scene depicting bright colourful flowers. They found that participants' reaction times for categorising the facial expression was enhanced when the scene in which it was embedded was emotionally congruent. Similarly, Russell & Fehr (1987) demonstrated that perception of a facial expression could be influenced by a previously seen face, for example, a face that was encountered first with a happy expression lead to the following neutral face being categorised as sad or unhappy. While no auditory information was presented with the face images in the silent condition of this study, it is possible that these faces were processed within the context of the other two conditions that were presented.

In their study, Bliss-Moreau, Barrett & Wright (2008) demonstrated that faces with neutral expressions which were previously evaluated could attain affective properties when those faces were associated with positive or negative social statements, such as “Greeted a good friend” or “Fired an employee before Christmas”. They found that after as little as two exposures, a face could be subsequently evaluated as positive or negative depending on the statements associated with it and these evaluations could persist for several days following the initial exposures.
As previously reported, some studies found that humorous individuals may also be associated with negative traits such as lower intelligence or trustworthiness (Bresler & Balshine, 2006). On the other hand, if humorous individuals are rated as more attractive than non-humorous individuals and have other positive traits such as sociability, as previously discussed (Cann & Calhoun, 2001), the non-humorous individual may be evaluated more negatively by comparison. In the silent condition, where only the face is seen, neither of these characteristics are associated with the face. As such, this could potentially explain why the average attractiveness rating for the silent condition sits somewhere in between the ratings to the other two vocal conditions. It is also possible that with repeated viewing of the silent face image, the mere exposure effect (Bornstein & D'Agostino, 1992; Seamon et al., 1995; Zajonc, 2001), may have further enhanced its attractiveness without any of the cost of negative associations from the vocal information. Bliss-Moreau, Barrett & Wright (2008) also noted that faces associated with neutral behaviour information, such as 'Passed a man on the street', did tend to increase the positivity of the evaluations of the face with the same number of repeated exposures as the positive and negative information. Furthermore Anderson, Siegel, Bliss-Moreau & Barrett (2011) suggested that faces that have been associated with a negative affect may dominate longer in conscious processing and be better remembered than neutral or positively associated faces due to the fact that a negatively perceived face may represent some type of threat. If non-humorous individuals were more negatively perceived, and subsequently better remembered, this may be reflected in a lower overall rating of the associated face as found in the current study. The type of scale used here allowed for the observation of the relative differences between vocal conditions, however, it
was insufficient to determine whether or not some faces, for example, the non-
humour faces, were better remembered than vision-only faces and if this was indeed a contributing factor to its relatively lower score.

While the scale used in the current study was specifically chosen to allow the participant make a more natural relative evaluation of the faces it only revealed a significant difference between the humorous and non-humorous conditions. This method did not allow enough sensitivity in determining whether or not these conditions were in fact differently evaluated from the vision only condition. In addition to using a continuum scale for more natural evaluations of faces future studies it may be beneficial to incorporate some type of forced-choice paradigm, as used in previous studies, to better understand the relative contribution of different sensory information.

As indicated in the introduction, previous studies have reported that males and females may differ significantly when evaluating humour and attractiveness in the opposite sex, however, no such difference was observed here. Although the result here is inconsistent with the result observed by Bresler & Balshine (2006) their study used a much narrower age range of participants, averaging around 19 years of age with a very small standard deviation. The open nature of experimental setting here allowed for a much broader range of participant ages here with mean age of around 30 years and a much larger standard deviation. The lack of observed difference may reflect an ageing component to the perception and evaluation of humour. While the current study does contain a range of younger, middle aged and older adults, the relative numbers in each group here does not allow for a meaningful statistical
The role of simultaneously presented cross-sensory social information on judgments of attractiveness

investigation. It may be beneficial for future studies to investigate the role of age on cross-modal effects on attractiveness by soliciting responses from a broad range of participants.

2.5 Conclusion

The results of the experiment reported here suggest a benefit for humorous verbal statements on the perceived attractiveness of an associated face image, but only when compared to non-humorous statements. Interestingly no significant difference in attractiveness was observed between a face that was seen by itself and a face that was associated with either humorous or non-humorous vocal content. The current study differs from others on the subject by making use of multi-sensory stimuli, allowing participants to attend to the information in a more naturalistic way than has been previously used and by using a scale rather than a forced choice design. The evaluation of humour and attractiveness in this type of setting may incorporate a number of factors including context and age. Future studies can potentially incorporate the findings here to gain a greater understanding of humour and its effects on attractiveness.
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

Abstract

The mere exposure effect (MEE) describes a process whereby increasing the frequency or duration of exposure to a visual stimulus increases the liking for that stimulus (Zajonc, 1968). The effect is typically obtained by repeating a single image of a face image which is randomly presented with other face images. In reality faces are commonly observed under a variety of visual conditions. Here I investigated whether the MEE is affected by facial expression or image changes, and we also investigated whether the MEE would work as a relative proportion of frequency against a fixed number of exposures. I found that increasing the frequency of exposure led to higher ratings of attractiveness across different facial expressions but did not appear to work where the frequency level was a proportion of overall exposure. The MEE also appears to be sensitive to image changes of the face. Outside of a specific set of experimental circumstances the effect is not robust, making practical applications difficult to achieve.

3.1 Introduction

Many articles and advertisements, across a wide variety of media platforms, espouse a myriad of ways to appear more attractive or more appealing. The nature of these messages is designed to promote multi-billion Euro companies that promise to provide information and solutions on how to be more attractive. Whether in the form of clothes, make up, fragrances or cosmetic surgery the widely held opinion is that such companies and their products hold the key to a person’s appeal. For the right
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

price, a person can be transformed from average looking to somebody who is instantly distinguished, appealing or attractive.

Despite the prolific ability of such companies to spread information about what is and is not appealing, scientific investigation has revealed that attractiveness and appeal is more than simply applying something to our external look but is more deeply rooted in our physiology and cognitive processes. In fact where a product claims to make a person appear above average or to stand out in some way, technically speaking the opposite is actually happening where a person’s appearance is brought closer to the scientific average. Of the many ways it is possible to increase the appeal or attractiveness of a person, some are seemingly quite simple.

The mere exposure effect (MEE) describes a process whereby increasing frequency or duration of exposure to a stimulus increases the liking for that stimulus. Zajonc (1968) first described the effect in his paper “Attitudinal effects of mere exposure”. In it, he demonstrated that increasing frequency, even to a stimulus such as a nonsense word increased “favourability of attitude” towards that word when compared with other nonsense words that were encountered less frequently. Zajonc noted that words with positive meanings such as “good”, “pretty” or “first” occurred more frequently in language than “bad”, “ugly” or “last” and that there was a strong correlation between preference ratings for these words and how frequently they were used.

Zajonc also demonstrated that the effect worked for photographs of an individual’s face. In the experiment, photographs of 12 male students, taken from a yearbook, were shown at frequencies of 1, 2, 5, 10 & 25 times each for a duration of 2 seconds
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

Participants were later asked to rate how much they liked the person in the photograph on a scale of 1 - 7. Faces seen at the higher frequency levels, of 10 and 25 times, were rated significantly higher than faces presented at lower frequency levels. In the following decades the MEE has been replicated many times across a wide array of stimuli including faces and novel three dimensional objects (Kramer & Parkinson, 2005; Jones & Allen, 2007; Seamon, 1999).

Examples of the MEE can be found in everyday life. The main function of advertising is to get the consumer to prefer a certain brand over another, thereby increasing the likelihood of a person purchasing that product. Repeated exposure to an advertisement has been shown to do exactly that, even if the content of the advertisement itself is ignored. Grimes & Kitchen (2007) demonstrated increased liking for a product that had been seen multiple times by a viewer even when the viewer could not necessarily remember the exact details of the advertisement.

Although the effect appears to be achieved quite easily in the visual domain, the effect is not limited to visual stimuli and can be easily observed in the auditory domain. Music is probably the most easily accessible example of the MEE in the auditory domain where preference for a song increases steadily over repeated listening (Lieberman & Walters, 1968; Peretz, Gaudreau & Bonnel, 1998). For example, Verrier (2012) demonstrated that songs that were heard in both the semi-final and final rounds of the Eurovision Song Contest received more points than songs that were only heard once during the final. Indeed a defining feature of music itself is repeating rhythms and melodies. Repetition of rhythm and melody likely promote
feelings of familiarity and subsequent liking as a piece is processed in a similar way as has been seen with other repeating stimuli.

Despite the interest and repeated replication, the exact mechanism of the MEE effect remains somewhat elusive. Some notable studies have shown that the effect can be induced in circumstances as varied as prenatal exposure to musical tones, where a preference for that tone can be demonstrated postnatally (Rajecki, 1974), to preferences for stimuli where an individual was not consciously aware of their presentation due to extremely short exposures in the 5-30msec range (Murphy, Monahan, & Zajonc, 1995). These examples demonstrate that inducing the effect requires little more than sensory exposure but offers little insight into how this effect is actually achieved either in terms of affect or cognitive processes. In a follow up paper, Zajonc (2001) stated that “the repeated-exposure paradigm consists of no more than making a stimulus accessible to the individual’s sensory receptors”.

A small number of theories have attempted to explain how simply encountering something frequently produces increased liking. In Zajonc’s original paper he proposed that initial exposure to any stimulus produces a fear reaction or avoidance reflex. When no negative consequences are associated with this first exposure the avoidance reaction weakens on subsequent exposures and “the organism’s attitude toward the stimulus must improve”. Although this may sound like a type of reinforced behaviour, Zajonc contends that because the exposures are not coupled with positive or negative outcomes and no change to approach or avoidance behaviours occurs, instead the mere exposure results in the enhancement of the person’s attitude towards that stimulus.
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

The Perceptual Fluency/Misattribution model proposed by Bornstein & D'Agostino (1992, 1994) suggests that affect is not based on increased liking but that individuals make inferences based on how easily a stimulus is recalled. They proposed that increased exposure to a stimulus, such as a face, makes that stimulus more familiar and is subsequently more easily perceived and encoded than unfamiliar stimuli, thus enhancing its overall perceptual fluency. Where now the stimulus is more easily processed or recalled, the individual may infer that the stimulus is better liked, therefore misattributing their evaluation of the stimulus.

On the other hand the Hedonic Fluency Model proposed by Winkielman & Cacioppo (2001) suggests that it is not a misattribution but is actually a result of a small positive affect occurring in response to the more easily processed image. They demonstrated that areas involved in affective processing showed higher activities when familiar pictures were presented compared to unfamiliar ones that required more attention and encoding.

While the MEE has attracted significant interest and has been shown to be a robust phenomenon which can be replicated (Jenkins et al, 2011; Kramer & Parkinson, 2005; Zebrowitz et al, 2008), the experimental paradigm in which it has been tested appears to be quite narrow.

In the classic MEE paradigm (Bornstein, 1992; Zajonc, 1968) the effect is induced by presenting target stimuli, in a discrete and discontinuous manner, where each can be shown repeatedly and appearing at different frequencies. A single stimulus exposure duration may be anywhere between 50msec – 2500msec or occasionally even subliminal. Following this, the participant is presented with the same stimulus seen
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

during the exposure phase once more in a separate rating block and asked to rate their liking for that stimulus, usually on a scale. Stimuli that appear more frequently are generally found to have benefitted from the MEE by being rated as significantly better liked than stimuli that appeared less frequently. The effect can also be demonstrated by presenting one of the previously seen stimuli with a novel unseen stimulus where the participant is then asked to choose which one they prefer, with the previously-seen stimulus being chosen more often as the preferred stimulus.

Within the domain of face preferences and the MEE, studies have tended to rely on a variety of stimuli, for example, photos from yearbooks. Typically such images are not a well-controlled set of stimuli, often featuring a wide array of lighting conditions, clothes, hair styles and facial expressions that tend towards smiling even where facial expression is not necessarily a factor in the experimental design. Other studies examining the MEE have used somewhat more controlled stimuli (Kniffin & Wilson, 2004) but have often only investigated its effect on neutrally expressive faces. Table 1 below illustrates a number of studies that have demonstrated the MEE, most of which have replicated the effect using the paradigm and types of stimuli outlined above.

Table 1: Some of the most typical approaches to establishing a MEE, showing the number of exposures per face identity, nature of presenting stimuli, expression used, presentation of rating phase.

<table>
<thead>
<tr>
<th>Author/Year</th>
<th>No. of Identities (ID)</th>
<th>No of Images (per ID)</th>
<th>Stimulus Expose duration</th>
<th>Facial Expression</th>
<th>Order of Presentation</th>
<th>Separate Rating block?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kramer &amp; Parkinson (2005)</td>
<td>24</td>
<td>4</td>
<td>1000ms</td>
<td>neutral</td>
<td>random</td>
<td>yes (immediately following)</td>
</tr>
<tr>
<td>Jones &amp; Allen (2001)</td>
<td>10</td>
<td>5</td>
<td>98ms</td>
<td>neutral</td>
<td>random</td>
<td>yes (5 minutes later)</td>
</tr>
<tr>
<td>Claypool et al (2007)</td>
<td>24</td>
<td>4</td>
<td>no limit</td>
<td>neutral</td>
<td>random</td>
<td>yes (8 mins later)</td>
</tr>
</tbody>
</table>
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Exposures</th>
<th>Duration</th>
<th>Expression</th>
<th>Presentation</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bornstein (1992)</td>
<td>25</td>
<td>1,5,10,20</td>
<td>5ms, 500ms</td>
<td>neutral</td>
<td>random</td>
<td>yes</td>
</tr>
<tr>
<td>Zajonc (1968)</td>
<td>9</td>
<td>1,2,5,10,20</td>
<td>2000msec</td>
<td>various/yearbook</td>
<td>random</td>
<td>yes, immediately following</td>
</tr>
<tr>
<td>Zebrowitz et al (2008)</td>
<td>20</td>
<td>10</td>
<td>1000msec</td>
<td>neutral</td>
<td>random</td>
<td>yes, presented with novel face</td>
</tr>
</tbody>
</table>

Few experiments examining the MEE have strayed outside this experimental paradigm or directly assessed the influence of facial expression. Furthermore many of these studies have replicated the effect by using the same manner of presentation and showing the same stimulus image at the exposure and rating phases.

Tracy & Beal (2011) have demonstrated that different facial expressions differentially impact on judgements of attractiveness and that these judgements also differ depending on whether the face is male or female. They found that expressions of happiness on female faces were rated as being significantly more attractive than a neutral expression but that a happy expression on a male face was less attractive than an expression of pride or shame. Willis, Palermo & Burke (2011) demonstrated that faces displaying angry expressions were less approachable than faces that were happy or neutrally expressive. The aim of the current study was to address whether or not facial expressions would affect the MEE differently. Specifically I questioned if increasing the exposure to a face that was neutral, happy or angry would be evaluated differently in terms of attractiveness: for example, would a face that was seen more frequently and with an angry expression decrease in attractiveness the more frequently it was exposed. I also sought to investigate whether or not the MEE would continue to be found when manipulations were made to the classic experimental design outlined above. I manipulated the design by changing the image of the face.
3.0 Investigation of the role of frequency of exposure and expression on judgments of attractiveness

From the exposure to the rating phase, I also changed the frequency with which a face image was shown with a certain expression in proportion to the total number of exposures of images of that face and finally to see if the MEE would occur when the images were presented in one continuous manner rather than discontinuous manner used in most studies. It was designed to discover if these experiments would further enhance our understanding of the how the MEE works and also if specific manipulations to the effect could be made which could have practical applications.

In Experiment 1 I used the classic experimental MEE paradigm but investigated it in terms of how facial expressions may affect it. I showed face images 2, 4 or 6 times each displaying either only a neutral, happy or angry expression. We then asked participants to rate the same image of the face for attractiveness during a follow up rating phase. In Experiment 2 we presented the faces in the same way during the exposure phase but I manipulated the classic experimental paradigm by changing the image of the person from the exposure phase, which may have been seen as happy or angry, to a neutrally expressive version of the same person. This specifically sought to address whether or not the MEE was image-dependent or person-dependent. In Experiment 3, I presented face images in the discontinuous manner found in the classic design but manipulated the frequency aspect. Here I displayed each face identity six times each but varied the proportion of frequency of expression to neutral of those six exposures. In Experiment 4 I presented the faces and proportions of exposure used in Experiment 3 but ran them as a single continuous exposure. Prior to conducting these experiments all face image stimuli were rated separately following a short single exposure. This was done to provide a comparison with the
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

following experiments where the image would be shown repeatedly and under varied conditions.

3.2 Pre Ratings Study

3.2.1 Introduction

Before examining the MEE under a variety of different experimental conditions, a ratings study was carried out using the face images that were used in Experiments 1 – 4. Face images were presented to a separate group of participants who rated each face immediately after a single short exposure. It was anticipated that getting a rating of attractiveness for these faces outside any experimental manipulations would provide a baseline comparison for the subsequent experiments.

3.2.2 Method

Participants & Inclusion Criteria

The participants were recruited on-line. A total of 186 participants (114 male, 72 female with a mean age of 34.4 years) from nine countries were recruited via Mechanical Turk through which consent was also obtained for participating. Each participant in this experiment received a payment of 80 cents (USD).

A pilot version of the rating study conducted in the laboratory found that the experiment took an average time of around 15 minutes. An initial inspection of the data from the online study revealed that some participants took several hours or even days to complete the rating study and it was suspected that they may not have been genuine participants or did not complete the study in one sitting. The mean time taken to complete the study by all participants was calculated and it was decided to remove all participants whose timing fell outside ±2 StDev of this mean. This range
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

extended from approximately 6 – 35 minutes which was believed to be a reasonable time in which to complete the ratings study. As such 11 participants from the original 186 were removed from further analyses due to their unusually long times taken, all of whom had taken several hours or more to complete it. Of the remaining 175 participants there were 107 males and 68 females with a mean age of 34.2 years (SD = 11.3). Their ages ranged from 19 to 66 years.

Apparatus & Stimuli

The data collected in this study were part of a larger experiment that involved collecting ratings for other stimuli for a separate experiment, however, the face images here were presented in their own separate block and were not mixed with any of the other stimuli being rated. The stimuli used in this experiment were comprised of a set if 36 images of 18 male and 18 female faces, each shown in a neutral expression with eye gaze directed straight ahead. These photos were obtained from the Radboud database of faces (Langner et al., 2010). Each face image was shown against a black background and was edited to remove external features such as hair and ears. This was done to prevent faces from being more easily recognised at the later rating phases and also served to allow us to specifically investigate the effect of facial expression rather than any preferences a participant may have had for hair colour etc. An example of these face images is presented in Figure 3.1. The experiment was run using the Xperim ent Mobi software and distributed via the Mechanical Turk online platform. The Xperim ent Mobi software ensured that all images for the experiment were preloaded into the participants’ device prior to conducting the experiment. This was done to speed up the
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

presentation of the stimuli and to control for any drop in connection that may have occurred while the participant was doing the experiment. The images loaded into the participants' devices were placed there only temporarily and were not available for access outside of the study.

Figure 3.1: Example of some of the faces and how they were edited for use in the current rating study and subsequent experiments. Faces in the rating study were shown individually and rated for attractiveness.

Design

A Likert-type scale was used to determine a participant’s response to the rating question. Participants dragged a slider along a line to indicate their response. Images were shown once, in a random order, with no time limit place on how long they could view the face before responding. There were a total of 36 faces to be rated by each participant. The dependent variable was rating of attractiveness.

Procedure

The experiment was conducted via the internet. Prior to the experiment, each participant was asked to provide basic demographic information including, age, sex and country of residence. Participants were instructed that they would be asked to view each face individually and rate that face for how attractive they found it. They were asked to rate the face for attractiveness using the line continuum where the left
end of the line indicated a response of ‘Very Unattractive’, and the right end ‘Very Attractive’. Participants dragged a slider along the continuum to indicate their response and were encouraged to use the full scale when considering their response. The scale was present in each trial, under every image. Participants were free to view the face for as long as they wished before committing to an answer. This method was chosen as it was not practical to accurately limit the exposure of the picture in every participant’s case due to varying connection speeds, loading times and device used.

3.2.3 Results

Participant Location Comparison

From the ISP address it was possible to determine the location of each participant. It was observed that a large group of participants were located outside Western Europe and the United States and as such may not have had the same level of exposure to the type of Caucasian faces used in this study. A number of studies have suggested that cultural background may impact on perceptions of attractiveness (Crogan, 2007; Furnham & Baguma, 1994; Tovee et al., 2006). As this rating study was to serve as a baseline comparison and subsequent experiments were to be carried out on a population who were predominantly exposed to Western European faces I sought to examine whether any significant differences in ratings were evident in the results between the two groups.

Participants were divided into two groups with the first group being predominantly from Western Europe/US and the second group being predominantly from Asia. Mean attractiveness rating scores for face stimuli were determined for both groups
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

and are plotted in Figure 3.2. The mean attractiveness for female and male faces were also determined and is plotted in Figure 3.3 below.

![Figure 3.2: Mean attractiveness ratings given to faces by participants located in Western Europe/United States and those located in Eastern/Asian locations. SE bars are shown.](image)

![Figure 3.3: Mean attractiveness ratings given to male and female faces by participants located in Western Europe/United States and those located in Eastern/Asian locations. SE bars are shown.](image)
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

A between groups ANOVA was conducted and found that there was a significant difference between the ratings of attractiveness given by each group $[F(1, 173) = 17.64, p = 0.000043, \eta^2_p = .09]$. Participants from Asian/Eastern countries gave higher overall ratings of attractiveness to the face images compared to their Western counterparts.

In order to provide the most accurate comparisons with subsequent experiments, participants located in Asia were excluded from further analysis. This left a total number of participants of 118, 50 female, 68 male, mean age of 34.4 years (SD=11.1) and age range of 19-66 years.

*Trial duration per face*

In order to provide a useful comparison with subsequent experiments where exposure times to the faces would be varied, the mean amount of time taken to view a single exposure to each face was determined. As it was not possible determine the exact duration of how long each participant viewed each face the average trial duration was determined in the following way: the total duration of the experiment was recorded for each participant. This total duration included the block of faces being rated as well as other blocks of stimuli that were being rated as part of the larger study. To factor in instruction reading time and debriefing instructions, 150 seconds were removed from each participant’s total time. The total number of trials used in the experiment, which was 172 trials, were then divided into the remaining time taken to complete the experiment. This resulted in the average time spent looking at each face stimulus, for each participant, was 4.55 seconds.
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

**Mean Attractiveness Rating**

The mean attractiveness ratings were determined for face images of females (rating = 3.29) and males (rating = 2.56). A paired t-test revealed a significant difference between ratings provided to the male and female faces \[t=(118) = -9.89, p=.00043\]: female faces were rated as more attractive, as illustrated in Figure 3.4.

![Figure 3.4: Plot shows mean attractiveness rating given by European/US participants to female and male faces. SE bars are shown](image)

3.2.4 Discussion

The aim of this rating study was determine a baseline attractiveness rating for male and female face stimuli following a single short exposure. All subsequent experiments would provide longer exposure durations, with any increase in attractiveness ratings compared to here being as a result of this additional exposure as proposed by the MEE. This rating study also established that ratings given to a face were influenced by the location of the participant with participants in Asian countries giving significantly higher ratings to faces than their Western European/United States counterparts.
3.3 Experiment 1

3.3.1 Introduction

The aim of this experiment was to investigate whether the MEE differs depending on the expression used during the exposure phase using the classic MEE paradigm outlined above. Typically the effect has been achieved using faces displaying a happy facial expression (Peskin & Newell, 2002; Zajonc 1968). Here I aimed to examine if the effect occurs equally across different expressions, including anger, which has been shown to negatively impact on the approachability and attractiveness of an individual (Tracy & Beal, 2011; Willis, Palermo & Burker 2011) or if that such a facial expression may lead to diminishing ratings of attractiveness. Neutral and happy facial expression were also used.

3.3.2 Method

Participants

18 undergraduate participants (9 female, 9 male with a mean age of 27.7 years, SD = 8.56) participated in this study. Their ages ranged from 18 to 50 years. All participants were self-reported as heterosexual. For taking part in the experiment participants received €5 or one research credit for Psychology students from Trinity College Dublin. Participants were briefed on the experiment protocol and provided informed, written consent prior to taking part.

Apparatus & Stimuli

The experiment was presented on a colour LCD monitor (1,024 x 768px) at a 60Hz refresh rate using Presentation software running on a 2.1Ghz PC with 1GB RAM. Responses were recorded via a standard PC keyboard.
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

The stimuli used in this experiment comprised a set of images of 36 models, 18 male and 18 female. These stimuli were from the same Radboud set used in the previous experiment. All models projected neutral, happy and angry expressions, and were facing forward with eye gaze straight ahead. Each face image was contained within an all-black background frame measuring 1024 x 681 pixels, subtending to a visual angle of 25.3° vertically and 17.2° horizontally at a distance of 60cm from the screen.

Design

The experiment was a within subject, fully factorial design with facial expression (neutral, happy, angry), exposure frequency (2, 4, 6 times) and sex of face as factors. Presentation of stimuli was blocked by expression and sex of face such that only one expression and one sex of the face was presented within a single block. The order of these blocks was counterbalanced across participants so that each face image was presented with each expression and at each level of frequency. Following each exposure block, participants were presented with a rating block where they rated each face they had seen for attractiveness. The faces rated in this block were the exact same image of the person that they had been previously in the exposure phase. The dependent variable measured was the rating of attractiveness.

Procedure

Participants were seated in front of a computer screen at a distance of 60cm and were provided with on-screen instructions about the task. Participants were presented with a block consisting of a total of 24 face images. This comprised of two face identities being shown twice, two face identities being shown four times and two face identities being shown six times. This made for a total of six separate individual face
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

identities per block. Each face exposure was 2 seconds long with an inter stimulus duration of 500msec. All 24 face images were shown in random order but order was constrained such that no same face identity appeared twice in a row. Following this exposure block there was a rating block where the exact same face image that had previously been seen was presented once more for 8 seconds after which the participant was asked to rate it for how attractive they found it on a scale of 1 – 7 where 1 was ‘very unattractive’ and 7 was ‘very attractive’. Participants were encouraged to use as much of the scale as possible and to answer as quickly as possible.

3.3.3 Results

For each of the participants, the mean attractiveness rating was calculated for each frequency level of facial expression, plotted in Figure 3.5. A 3 (expression) x 3 (frequency) ANOVA found no significant effect for expression \(F(2,17) < 1\). However a significant main effect of frequency was found \(F(2,17) = 4.167, p=0.024, \eta^2_p = .19\). A follow up Tukey post-hoc analysis showed a significantly higher rating of attractiveness for faces that were seen 6 times compared to 2 or 4 times, but no difference between the 2 or 4 exposures. No interaction between expression and frequency was observed \(F(4,17) < 1\).
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

Figure 3.5: Plot shows mean attractiveness scores for faces by expression and number of exposures. In this experiment the exposure faces and rating faces were identical. SE bars of the mean are shown.

To investigate whether the sex of the face stimulus had any effect on participants’ responses a 3x3x2 ANOVA was carried out. There was no main effect of expression and the same main effect of frequency as above was observed however no significant effect of sex of stimulus was found [F(1,17) = 1.853, p<1]. Similarly no interactions were observed. A plot of scores for male and female face stimuli can be seen in Figures 3.6 and 3.7.
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

Figure 3.6: Plot shows mean attractiveness rating for female faces by expression and number of exposures. SE bars of the mean are shown

Finally a comparison was made between the ratings for the faces seen here six times (maximum frequency) with the ratings established in the online ratings to see if there
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

was any overall benefit of this increased exposure compared to a single exposure. This comparison was made using the neutral expression only. A Mann Whitney U test observed that there was a significant difference in ratings given by the online and experimental groups for male faces (Mann-Whitney U=434, p=.0005, sig<.05) and female faces (Mann-Whitney U=697, p=.01, sig<.05). An inspection of the means showed that the experimental group gave higher ratings of attractiveness to faces than their online counterparts, see Figure 3.8.

![Figure 3.8: Mean attractiveness rating for male and female faces given by the online group following a single exposure and the experimental group following six exposures. There was a significant difference between the ratings given by the two groups in the case of both sexes. SE bars of the mean are shown.]

3.3.4 Discussion

The aim of the current experiment was to not only examine the MEE across different facial expressions but whether or not this effect would differ depending on the facial expression. A main effect of frequency was observed in the experiment where faces seen 6 times were rated as being more attractive than faces seen 4 or 2 times.
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

However, the type of expression had no significant effect on ratings. From Figure 5 it appears that all faces with all types of facial expression increased in attractiveness as a function of exposure frequency.

Although the sex of the face stimulus did not affect the overall rating score as indicated by the lack of interactions, an inspection of means for male faces show that increases in attractiveness ratings were more consistent across 2, 4 and 6 exposures when compared with female faces.

When compared to a single exposure, as seen in the online ratings study, it appears that repeated exposure was sufficient to produce higher ratings of attractiveness. However where the online ratings study found an effect of the sex of the face, no such effect was observed here. This result could be caused by the discontinuous and discrete nature of the presentations or the mixing of facial expression not present in the online study.

The current study replicated the MEE by showing that repeated exposure to a face stimulus increased the ratings of attractiveness for that stimulus. However here I extended the findings to indicate that this effect occurred across different facial expressions and the effect of repeating the image appeared to influence the ratings more than the facial expression.

3.4 Experiment 2

3.4.1 Introduction

In Experiment 1, the classic experimental paradigm found in most MEE experiments was used to investigate the effect across different expressions. The same face image of the person was repeatedly observed by the participant during the exposure phase
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

and later rated during the rating phase. In this experiment the same procedure from Experiment 1 was used except that during the rating phase a neutral expression of the identity was always used, regardless of the expression that identity was seen with during the exposure phase. The purpose of this change was to investigate whether or not the MEE was specific to a repeated image or if it held across different images of the same person.

3.4.2 Method

Participants

A total of 54 undergraduate participants (27 female, 27 male with a mean age of 22.3 years, SD = 4.07) participated in this study. Their ages ranged from 18 to 32 years. All participants were self-reported as heterosexual. Participants received either €5 or one research credit for Psychology students from Trinity College Dublin for taking part. Participants were instructed as to the task and provided written consent before taking part in the study.

Apparatus & Stimuli

The experiment was conducted in a testing lab in Trinity College. Stimuli were presented on a colour LCD monitor (1,024 x 768px) at a 60Hz refresh rate, and the experiment was programmed using Presentation software running on a 2.1Ghz PC with 1GB RAM. Responses were recorded via a standard PC keyboard. The stimuli used in this experiment comprised the same set of images of 36 models, 18 male and 18 female used in Experiment 1.

Design
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

The experiment was based on a within subject, fully factorial design with facial expression (neutral, happy, angry), exposure frequency (2, 4, 6 times) and sex of face as factors. Presentation of stimuli was blocked by expression and sex of face such that only one expression and one sex was presented within a single block. The block order was counterbalanced across participants so that each face image was presented with each expression and at each level of frequency. Following the exposure block participants were shown a rating block where they rated a neutrally expressive version of faces they had seen for attractiveness. The dependent variable measured was the rating of attractiveness.

Procedure

Participants were seated in front of a computer screen at a distance of 60cm and were provided with on-screen instructions about the task. Participants were presented with a block consisting of 24 total face exposures. This comprised of two face identities being shown twice, two face identities shown four times and two face identities shown six times, which made for a total of six separate individual face identities per block. Each face exposure was 2 seconds long with an inter stimulus duration of 500msec. All 24 face images were shown randomly but order was constrained such that no same face identity appeared twice in a row. Following this exposure block there was a rating block where each face was presented once more for 8 seconds. For this experiment the face shown was always a neutrally expressive version of the same face they had seen during the exposure phase. After viewing this face the participant was asked to rate it for how attractive they found it on a scale of 1 – 7 where 1 was ‘very unattractive’ and 7 was ‘very attractive. Participants were
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

encouraged to use as much of the scale as possible and to answer as quickly as possible.

3.4.3 Results

For each of the participants, the mean attractiveness rating was calculated for each frequency level of facial expression, plotted in Figure 3.9. A 3 (expression) x 3 (frequency) ANOVA found no significant effect for expression \( F(2,53) = 1.605, p=.2 \). However a significant main effect of frequency was found \( F(2,53) =3.164, p=0.04, \eta^2_p =.05 \). A follow up Tukey post-hoc analysis revealed a significantly higher rating of attractiveness for faces that were seen 6 times compared to 2 or 4 times, but no difference between 2 or 4 exposures \((p<.05)\). No interaction between expression and frequency was observed \( F(4,53) = 1.183, p=.31 \).

![Figure 3.9: Plot shows mean attractiveness rating for faces by expression and number of exposures. In this experiment the face shown during the rating phase was always the neutral version regardless of the expression it was seen with during the exposure phase. SE bars are shown](image-url)
To investigate whether the sex of the stimulus had any effect on participants' responses, a 3x3x2 ANOVA was carried out. No main effect of expression was observed [$F(2,53) = 1.605, p = .2$]. A significant main effect of frequency was found [$F(2,53) = 3.164, p = 0.04, \eta^2_p = .05$]. A follow up Tukey post-hoc analysis showed a significantly higher rating of attractiveness for faces that were seen 6 times compared to 2 or 4 times ($p < .05$). A significant main effect of sex of stimulus was found [$F(1,53) = 5.35$, $p = .024, \eta^2_p = .09$]. An analysis of the means showed that female faces received significantly higher rating of attractiveness than male faces. A plot of scores for male and female face stimuli by expression can be found in Figures 3.10 and 3.11. No significant interactions were observed.

![Figure 3.10: Plot shows mean attractiveness rating for female faces by expression and number of exposures. SE bars of the mean are shown](image-url)
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

Finally a comparison was made between the ratings for the faces seen here six times (maximum frequency) with the ratings established in the online ratings to see if there was any overall benefit of this increased exposure compared to a single exposure. This comparison was made using responses from the neutral expression in this experiment. A Mann Whitney U test revealed that there was a significant difference in ratings given by the online and experimental groups for male faces (Mann-Whitney U=1889, p=.0001, sig≤.05) and female faces (Mann-Whitney U=9504, p=.02, sig≤.05). An inspection of the means showed that the experimental group gave higher ratings of attractiveness to faces than their online counterparts, see Figure 3.12.
3.0 Investigation of the role of frequency of exposure and expression on judgments of attractiveness

Figure 3.12: Plot shows mean attractiveness rating for male and female faces given by the online group following a single exposure and the experimental group following six exposures. There was a significant difference in ratings given by each group. SE bars of the mean are shown.

3.4.4 Discussion

Similar to the results of Experiment 1, the results of the current experiment demonstrated an increase in attractiveness ratings as frequency of exposure increased. The type of expression had no significant effect on ratings. From Figure 8 it appears that faces increased in attractiveness as a function of exposure frequency and not facial expression. Notably this experiment required more participants before finding a main effect of frequency. A comparison of the partial eta-squared also showed that the effect for frequency here $\eta^2_p (.05)$ was smaller than Experiment 1, $\eta^2_p (.19)$. Although in Experiment 1 a general increase in attractiveness ratings across all expressions can be seen, the increased ratings of attractiveness in the current experiment appear to only be evident in the happy and angry expressions. Notably, no pattern of increasing ratings can be seen in the neutral expression condition.
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

however the lack of interaction fails to explain this. This is examined further in the general discussion.

Although the results are broadly similar to those found in Experiment 1 the additional participants required to find an effect of frequency as well as being weaker than the effect of frequency from Experiment 1 may suggest that the change of image from the exposure to the rating phase affected responses. The change of image at the rating stage may have affected the participant’s recognition of that face making any benefit of increased exposure more difficult to ascribe to that face. The difference in results between Experiment 1 and 2 suggest that effect may be image dependent and does not easily transfer across different images of the same person.

3.5 Experiment 3

3.5.1 Introduction

In this experiment I aimed to examine whether a MEE could be achieved outside the classic experimental paradigm. To investigate this I showed faces an equal number of times but varied how frequently a specific facial expression of that person appeared as a proportion of that total number of exposures. Specifically I showed each face identity 6 times each but varied how frequently the face images were shown with a happy or angry expression in relation to a neutral version of that face. This was to test whether or not the MEE occurred as a result of the absolute frequency of exposures, as used in the classic design, or if the effect could be achieved as a function of relative frequency of facial expressions.

3.5.2 Method

Participants
3.0 Investigation of the role of frequency of exposure and expression on judgments of attractiveness

Twenty undergraduate participants (12 female, 8 male, mean age of 22 years, SD=2.13) participated in this study. Their ages ranged from 19 to 28 years. All participants were self-reported as heterosexual. For taking part in the experiment, participants received €5 or one research credit for Psychology students from Trinity College Dublin. Participants were instructed as to the task and provided written consent before taking part in the study.

Apparatus & Stimuli

The experiment was presented on a colour LCD monitor (1,024 x 768px) at 60Hz refresh rate using Presentation software running on a 2.1Ghz PC with 1GB RAM. Responses were recorded via a PC keyboard. 32 faces (16 male, 16 female) were taken from the same set of stimuli used in Experiments 1 and 2.

Design

The experiment was a within subject, fully factorial design with facial expression (happy, angry), their relative exposure frequency (0, 2, 4 or 6 times) as function of all 6 exposures for that face and sex of face as factors. Presentation of stimuli was blocked by expression and sex of face such that only one expression (relative to neutral) and one face sex was presented within a single block. Block order was counterbalanced across participants so that each face image was presented with each expression and at each level of frequency. Following the exposure block participant were shown a rating block where they rated the faces they had seen for attractiveness. The faces viewed during the rating phases were the neutral version of the identity they had seen during the exposure phase. The dependent variable measured was the rating of attractiveness.
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

**Procedure**

Participants were seated in front of the screen at a distance of 60cm and given on-screen instructions about the task. The experiment consisted of eight blocks of trials, four containing male faces (2 happy, 2 angry) and four containing female faces (2 happy, 2 angry). Each block contained separate exposure and rating phases.

During the exposure phase four face identities were each shown over six face images, totalling 24 images. Each face identity appeared at one level of relative expression frequency (see Table 2 for example). Each face image was shown for 2 seconds with an inter-stimulus duration of 500msec. All 24 face images were shown randomly but constrained such that no same face identity appeared twice in a row. Following this exposure block there was a rating block where each face was presented once more for 8 seconds. For this experiment the face shown was always a neutrally expressive version of the same face they had seen during the exposure phase. After viewing this face the participant was asked to rate it for how attractive they found it on a scale of 1 – 7 where 1 was ‘very unattractive’ and 7 was ‘very attractive. Participants were encouraged to use as much of the scale as possible and to answer as quickly as possible.

**Table 2:** The relative proportion of expressive frequency each facial identity was shown within a block. All faces were shown an equal number of times but differed in how often they may have been show smiling or angry relative to neutral. Faces were shown in a pseudo-random and discrete manner.

<table>
<thead>
<tr>
<th>Face ID</th>
<th>No. of Neutral Images</th>
<th>No. Expressive Images</th>
<th>Total No. of Exposures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

3.5.3 Results

Firstly, to establish whether facial expression made a difference to the overall mean attractiveness rating for a face I compared ratings for faces that were seen all neutrally, all happy and all angry, plotted in Figure 3.13. Overall, facial expression did not affect attractiveness ratings $[F(2, 19) < 1]$, 95% CIs [3.18, 3.88], [3.04, 4.03] and [3.17, 4.07], respectively.

![Figure 3.13: Mean attractiveness rating for faces that were seen fully as one expression and not a proportionate amount of expression. Error bars indicate 95% CI.](image)

As I was interested in whether the relative proportion of frequency of facial expression shown affected ratings, I ran a 2 (expression) x 3 (frequency level) ANOVA excluding faces that had been seen neutral for 100% of their exposures. No significant effect of expression was observed $[F(1, 19) = 2.6761, p = .11]$. There was no significant effect of frequency $[F(2, 19) < 1]$. No significant frequency by expression interaction was observed $[F(2, 19) < 1]$. 
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

![Figure 3.14: Mean attractiveness rating given to faces seen in Happy or Angry expressions where presentation of stimuli were discontinuous. SE bars of the mean are shown](image)

To examine whether the sex of the face affected ratings of attractiveness a 2 (expression) x 3 (frequency) x 2 (sex) was carried out. No significant effect of expression was observed \[F(1,19) =2.6761, p=.11\]. There was no significant effect of frequency \[F(2,19) <1\]. There was also no significant effect of sex of stimulus \[F(1,19) =3.17, p=.09\]. There were no interactions between any of these factors. Plots of male and female stimuli can be seen in Figures 3.15 and 3.16.
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

Finally a comparison was made between the ratings for the faces shown here six times (maximum frequency) with the ratings established in the online ratings to see if there was any overall benefit of this increased exposure compared to a single exposure. This comparison was made using the neutral expression. A Mann Whitney U test revealed that there was a significant difference in ratings given by the online and
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

experimental groups for male faces (Mann-Whitney U=664, p=.001, sig<.05) but not female faces (Mann-Whitney U=970, p=.2, sig<.05). An inspection of the means showed that the experimental group gave higher ratings of attractiveness to male faces than their online counterparts, see Figure 3.17.

![Figure 3.17: Mean attractiveness rating for male and female faces given by the online group following a single exposure and the experimental group following six exposures. There was a significant difference in ratings given by each group for male faces. SE bars of the mean are shown.](image)

3.5.4 Discussion

Overall the results of the current experiment suggest no change in attractiveness ratings relative to the proportion of facial expressions presented. Neither ‘happy’ nor ‘angry’ expressions produced significant changes in the later ratings of perceived attractiveness. The lack of significant effects of either frequency level or facial expression in Experiment 3 may have reflected participants’ lack of ability to integrate and build up a representation of each face identity across the different face images due to the nature in which the face stimuli were presented. When presented at these proportional frequency levels, the random and discrete nature of each stimulus
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

Presentation may have made it difficult for the participant to recognise how many exposures of a face were expressive and how many were neutral. To this end the experiment was redesigned to present all face identities and their relative frequency levels as a single continuous exposure in Experiment 4.

3.6 Experiment 4

3.6.1 Introduction

The results from Experiment 3 suggested that participants may have had difficulty in recognising how many of the exposures they saw of a face were expressive and how many were neutral due the discrete and random nature of their presentation. In this experiment I aimed to address this problem by presenting the same set of stimuli at the same proportions of frequency of expression, but to run each face identity as one continuous single exposure. This would allow us to further investigate if the proportion of expression affected ratings of attractiveness and also whether or not a type of MEE would occur when the nature of the presentation was changed, specifically from the random and discontinuous nature of the classic paradigm, to presenting all images of a face as one single exposure.

3.6.2 Method

Participants

Forty-eight undergraduate participants (28 female, 20 male with a mean age of 22.2 years, SD=5.65) participated in this study. Their ages ranged from 18 to 48 years. All participants were self-reported as heterosexual. For taking part in the experiment, participants received €5 or one research credit for Psychology students from Trinity
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

College Dublin. Participants were instructed as to the task and provided written consent before taking part in the study.

**Apparatus & Stimuli**

The experiment was presented on a colour LCD monitor (1,024 x 768px) at 60Hz refresh rate using Presentation software running on a 2.1Ghz PC with 1GB RAM. Responses were recorded via a standard PC keyboard.

Stimuli and their proportions of expression were identical to those used in Experiment 3.

**Design**

The experiment was a within subject, fully factorial design with facial expression (happy, angry) and their relative exposure frequency (0, 2, 4 or 6 times) as function of all 6 exposures for that face as factors. However during the exposure phase each face identity was presented as one continuous single exposure. Presentation of stimuli was blocked in the same way as Experiment 3. These were counterbalanced across participants so that each face image was presented with each expression and at each level of frequency. Following the exposure block participants were shown a rating block where they rated a neutral version of the faces they had seen for attractiveness. The dependent variable measured was the rating of attractiveness.

**Procedure**

Participants were seated in front of the screen at a distance of approximately 60cm and given on screen instructions about the task. The experiment consisted of eight blocks. Each block contained a separate exposure and rating phase.
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

Unlike Experiment 3 where each exposure of a face image was separate and order was randomised, all 6 images for each face identity were shown sequentially with no inter stimulus interval, resulting in a single exposure lasting 12 seconds. Face identities were shown in random order. An example of the manner in which each of these face identities were presented is illustrated in Table 3 below.

Table 3: Illustration of the manner in which relative frequency of expression was shown throughout a single continuous exposure to a face. The above example shows how ‘happy’ (H) expressions were embedded into a sequence with their ‘neutral’ (N) counterparts. The same manner was used for blocks containing ‘angry’ expressions. Face identities were shown in random order.

<table>
<thead>
<tr>
<th>EXPOSURE NUMBER</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face 1</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Face 2</td>
<td>N</td>
<td>N</td>
<td>H</td>
<td>H</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Face 3</td>
<td>N</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>N</td>
</tr>
<tr>
<td>Face 4</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
</tbody>
</table>

Following exposure to all four face identities within a block, each face was again seen in a rating block. Each face was shown for 8 seconds in their neutral expression, after which the participant was asked to rate the face for how attractive they found it. The scale used was a seven point scale, where 1 was ‘very unattractive’ and 7 was ‘very attractive’. Participants were encouraged to use as much of the scale as possible and to answer as quickly as possible.

3.6.3 Results

Firstly, to establish whether facial expression made a difference, the overall mean attractiveness rating for a face were compared for faces that were seen all neutrally, all happy and all angry; these are plotted in Figure 3.18. Overall, facial expression did
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

not affect attractiveness ratings \(F(1, 47) < 1\), 95% CIs [3.24, 3.79], [3.41, 3.90] and [3.41, 3.91], respectively.

![Figure 3.18](image)

**Figure 3.18:** Plot shows comparison for mean attractiveness rating for faces that were seen fully as one expression and not a proportionate amount of expression. Error bars indicate 95% CI.

Similar to Experiment 3 as I was interested in how the relative proportion of frequency of expression contributed to ratings I ran a 2 (expression) x 3 (frequency level) ANOVA excluding faces that had been seen neutral for 100% of their exposures. A main effect of expression was observed in this ANOVA \(F(1, 47) = 4.769, p = .034, \eta^2_p = .09\). An analysis of the means showed a significantly higher rating of attractiveness for faces with 'angry' expressions. There was no significant effect of frequency \(F(2, 47) = 1.994, p = .31\). Finally no significant expression by frequency interaction was observed \(F(2, 47) = 2.01, p = .13\). Means for each expression and frequency level are plotted in Figure 3.19.
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

Figure 3.19: Plot shows mean attractiveness rating given to faces seen in Happy or Angry expressions where presentation of stimuli was proportionate and continuous. SE bars of the mean are shown

To investigate whether the sex of the stimulus had any effect on participants responses a 2x3x2 ANOVA was carried out. The same main effects results were replicated here as above. No significant effect of sex of stimulus was found \[F(1,47) = 1.214, p = .27\]. A plot of scores for male and female face stimuli can be found below in figures 3.20 and 3.21. An inspection of the means in these graphs indicates a trend for increased ratings for faces that are seen with a higher frequency of ‘happy’ expressions.
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

Finally a comparison was made between the ratings for the faces seen here six times (maximum frequency) with the ratings established in the online ratings to see if there was any overall benefit of this increased exposure compared to a single exposure. This comparison was made using responses from the neutral expression in this
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

experiment. A Mann Whitney U test revealed that there was a significant difference in ratings given by the online and experimental groups for male faces (Mann-Whitney U=1481, p=.00001, p<.05) but not female faces (Mann-Whitney U=2551, p=.2, p<.05). An inspection of the means showed that the experimental group gave higher ratings of attractiveness to male faces than their online counterparts, see Figure 3.22.

![Figure 3.22: Mean attractiveness rating for male and female faces given by the online group following a single exposure and the experimental group following six exposures. There was a significant difference in ratings given by the two groups. SE bars of the mean are shown](image)

3.6.4 Discussion

Unlike Experiment 3, facial images taken from each identity were presented in a continuous manner to try and allow processing of differing frequency levels of expression easier for the participant. Although no overall effect of frequency was observed in either experiment, an inspection of Figure 19, shows a more notable distinction between ratings given at each level of frequency for 'happy' expressions than was observed in Figure 12 from Experiment 3. This may suggest that in the form
3.0 Investigation of the role of frequency of exposure and expression on judgments of attractiveness

of a continuous presentation participants in Experiment 4 found it easier to distinguish frequency levels from one another.

3.7 General Discussion

The aim of this series of experiments was to investigate the extent to which the MEE may be used in changing perceived attractiveness of unfamiliar face identities. In Experiment 1 the classic MEE paradigm was used to probe whether or not the type of expressions displayed on a face would differ from each other in those conditions. An effect of frequency was found, where increased exposure to faces resulted in higher ratings of attractiveness, however, the type of expression did not significantly influence those ratings. The aim of experiment 2 was to determine if a change in the classic paradigm, by changing the image of the same face between exposure and rating, still produced an effect of frequency. Although an effect of frequency was observed, this effect was weaker than the classic paradigm used in Experiment 1, suggesting that the MEE is more image-dependent rather than person dependent.

The aim of Experiment 3 was to investigate whether a MEE could be attained outside the classic experimental paradigm by showing faces an equal number of times but varying the proportion of 'happy' or 'angry' expressions contained within those exposures. No effect for either frequency or type of expression was found in this experiment. The nature of the presentation, random and discrete, may have affected the participant's ability to accurately identify the exact proportion of expressive to neutral exposures of each face. Experiment 4 aimed to address this issue presenting all face images of each identity as one continuous exposure, allowing us to better investigate if proportion of frequency affected ratings of attractiveness, and whether
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

or not a type of MEE would occur when the discontinuous nature of the classic paradigm was changed. Although a main effect of expression was found, the proportionate amount of frequency of expression had no significant effect. These results combined with the results of Experiment 3 suggest that the MEE is better achieved as a function of the absolute frequency of exposure. The continuous nature of Experiment 4 however may make the effect of expression easier to differentiate between face identities.

The results collected from an online rating study of a single exposure to all the faces used in these studies suggest a lower overall rating for the faces than when they were viewed in the current set of experiments. In all cases the exposure times in the experiments were higher than the single online exposure rating suggesting that increased exposure does lead to increased liking of that stimulus.

Some of the results here have shown support for previous theoretical models of the MEE (Bornstein & D'Agostino, 1992; Winkielman & Cacioppo, 2001). However, the results collected in the current experiments have highlighted the difficulty in using the MEE for enhancing liking for a stimulus outside a specific set of experimental circumstances. The results discussed here will address these findings in relation the overall strength and robustness of the MEE and also in terms of some of the theories proposed by Zajonc (1968), Bornstein & D'Agostino (1992, 1994) and Winkielman & Cacioppo (2001) to account for the mechanism involved in the MEE. The methodology used here will also be compared to that of previous studies.

One of the original questions set out in the current studies was whether or not the MEE would occur across differing expressions. Given that nearly all social interactions
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

with others involve some changes of expression (Ekman, 2007), it is probable that this has at least some influence on how attractive a person is perceived to be. Tracy & Beall (2011) demonstrated that not all expressions are equally attractive: for example expressions of happiness on female faces were rated as being significantly more attractive than a neutral expression but that a happy expression on a male face was less attractive than an expression of pride or shame. If expressions are evaluated differently in terms of attractiveness it is reasonable to question whether or not the level of exposure to these expressions could lead to different evaluations. If angry faces produced a negative response, such as an avoidance reaction (Willis, Palermo & Burke, 2011), it may have been reasonable to suggest that angry faces encountered more frequently could become less attractive, or vice versa with happy faces. No evidence was found in the first three experiments to demonstrate that expression had any effect on attractiveness ratings or that it interacted with level of frequency. In their study Tracy & Beal asked each participant to view and rate only a single image of a person displaying a single facial expression. However the general trend observed in Experiments 1 and 2 was that faces were rated as more attractive the more frequently they were seen regardless of expression. This suggests that, in the short term at least, the attractiveness of a person may be more heavily influenced by how often that person is seen and less dependent on their expression. The increase in ratings of attractiveness across all expressions seen here also lends support to some of the theoretical components behind the MEE. In his original paper, Zajonc proposed that initial reactions to an unfamiliar stimulus is one of fear or avoidance and that when no negative consequences are experienced successive encounters reduce that reflex thus enhancing the liking for that stimulus. Where the expression may have
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

been angry, additional exposures may lead to less negative or avoidant reactions. Similarly the more frequently the identity was seen, even with an angry expression, the fluency and recall of that identity should be improved.

In trying to probe the limits and extent of the MEE it was necessary to begin manipulating the design away from its classic set up. In Zajonc’s original study and many of the studies mentioned above (Bornstein, 1992; Jones & Allen, 2001; Kramer & Parkinson, 2005), a single expression was used, most often smiling, and the same image was later rated. Here in these experiments we sought to examine if the effect would occur or differ using a range of expressions. As each participant was exposed to all types of expression during the experiment it is possible that this may have led to some context effects. A number of studies have illustrated that faces containing different expressions may be evaluated differently when they are presented together rather than in isolation (Barrett, Mesquita & Gendron, 2011; Wieser & Bosch, 2012 Barrett, Mesquita & Gendron, 2011). Despite employing a fully counterbalanced design, participants would have encountered differing order of expressions during the experiment. For example one third of participants would have encountered ‘happy’ expressions first, one third ‘angry’ expression and one third ‘neutral’ expressions. The first expression encountered may have led to dissimilar evaluations of faces seen later.

During debriefing, all participants were asked to identify the expressions seen during the experiment. All participants correctly identified happy and angry expressions, however approximately one third failed to identify the neutral expression, and instead reported seeing faces that were “bored”, “frustrated”, “sad” etc., which may
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

have been due to an evaluation after being exposed to happy or angry expressions in their initial blocks. This difference in evaluation could be a possible explanation for the apparent lack of increase found across the neutral exposures observed in experiment 2. Furthermore a neutral expression may appear to be less interesting or captivating when compared with the other expressions seen possibly interfering with later fluency effects. In future experiments it may be advisable to use a between subjects design to rule out any context effects.

It is possible that the mixed set of results found between Experiments 1 and 2 and Experiments 3 and 4 may also represent differences in the methodology used. In the first two experiments only minor variations from the classic design were made (i.e. the use of different expression and the changing of the image of the person from exposure to rating). However even these minor changes did lead to a weaker effect in the second experiment. In Experiments 3 and 4 it could be argued that I was no longer using the classic paradigm for the MEE I may in fact be trying to measure something else. In using a set number of exposures for each face identity the absolute level of frequency is the same for all stimuli and so the MEE simply may not occur as it is known in the classic paradigm. Furthermore the change of image of the face identity from expressive to neutral during the exposure phase is another feature not present in the classic paradigm. Not only does this feature take it further away from the classic design but, as shown in Experiment 2, may also weaken the effect as a whole. Finally in Experiment 4 where the difficulty of integration of the face images into a single identity for the participant is addressed, the design not only includes the same absolute level of exposure and image change, but also presents the identity in one continuous exposure. Although it can be argued that this represents a more
naturalistic presentation of a person, as we may encounter them in real life, it too differs from the classic discontinuous manner of presentation found in the original design.

The failure to find an effect of frequency in Experiment 4 suggests that discrete exposures of a face image may be better at producing a MEE. If the continuous exposure method used in Experiment 4 was treated as a single exposure, it is possible that initial avoidance reaction remains unchanged due to only a single evaluation reaction. These results may suggest that discrete and separate exposures are important as they allow the re-evaluation of stimuli and weakening the initial avoidance reaction.

The theoretical models outlined above have also advocated a perceptual fluency component in the MEE. The results found here appear to support this component in their models. In Experiment 2 the change of image from exposure to rating may have made identifying the individual more difficult. The fluency benefit from having observed the identity multiple times previously, but in a different expression, may not transfer to another expression of that face even though the identity remains the same. The weakened frequency effect observed in Experiment 2 compared to Experiment 1 likely reflects a greater difficulty in recalling or recognising the identity reducing the overall enhancement provided by perceptual fluency. Similarly in Experiments 3 and 4 where the absolute level of exposure is equal across all identities, the perceptual fluency model should mean that all faces could be recalled with the same ease. The failure to find a significant difference across the different proportions of expression could simply mean that perceptual fluency of each identity was
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

approximately equal due equal levels of exposure. However it cannot be ruled out that processing and recollection of faces was more difficult in Experiments 3 and 4 where the expression changes were seen for identities during the experiment.

There are other studies that share similar timing properties and number of stimuli to the current set of studies (Claypool et al., 2007; Kramer & Parkinson, 2005; Peskin & Newell, 2004; Zajonc, 1968). Other studies have shown evidence to suggest that shorter exposure and rating durations also robustly produce the effect (Bornstein, 1992; Jones & Allen, 2001; Young & Claypool, 2010). Furthermore other studies (Kawakami & Yoshida, 2011; Murphy, Monaghan & Zajonc, 1995; Zajonc, 1980) have also noted that the effect is at its strongest when stimuli were presented below the threshold of conscious awareness.

If shorter presentation durations at the exposure and rating phases produce stronger effects then the longer durations used in the current studies may have affected the strength of the MEE observed here. Several of the studies above have also used shorter rating durations or imposed no time limit on responding. In the current studies our rating phase exposure was set at 8 seconds and the participant was unable to respond until after it had been displayed. It is possible that the length of the rating phase in these may have had an influence on the participants rating evaluation. At a rating phase exposure length of 8 seconds this would have significantly added to the overall length of exposure to the identity. Where the frequency of exposure to the stimulus was in the low range, this long exposure may have had more of an influence on the participant rather than what was observed during the exposure phase. This could also have been more pronounced where there was a change in expression from
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

exposure to rating, for example where an identity was observed twice during the exposure phase displaying an angry expression it would have been later observed in a neutral expression for 8 seconds.

3.8 Conclusions

The results of Experiments 1 & 2 showed that the MEE is replicable and is a relatively robust phenomenon and indicate that the MEE can occur across a range of different expressions. They also demonstrate that the contribution of frequency of exposure was more important in influencing ratings of attractiveness than the expression of the face. The results of Experiments 3 & 4 demonstrated that the relative frequency of expression across a fixed number of exposures did not have a significant impact on attractiveness ratings. The results also indicate that the MEE may only occur under a specific set of experimental circumstances and may not be flexible outside of that.

Although the results across all four experiments appear to lend support to some of the leading theories regarding the mechanism for the effect, Experiments 3 & 4 may be too removed from the classic MEE design to be considered as supporting evidence for those theories directly addressing that design.

In light of these studies it is possible to gain a better understanding of the MEE by addressing some of the methodological issues outlined here. Finally it would appear that overall, perceptual fluency is important in producing the MEE in faces. It may be valuable to examine the effect on those with facial processing difficulties. For example Grieve & Bauer (1990) reported that a prosopagnosic individual showed a preference for previously seen faces over unfamiliar ones despite being unable to recognise the faces. Similarly it would be useful to extend the investigation to other
3.0 Investigation of the role of frequency of exposure and expression on judgements of attractiveness

sensory modalities: music in particular may be a useful avenue to investigate these questions due to its inherent repetitions of rhythms and melodies.
4.0 The role of age of stimulus and age of participant on evaluation of attractiveness

Abstract

To date the majority of research on perception of attractiveness has used younger adult participants rating predominantly young facial stimuli. Recent research has found that factors influencing attractiveness of faces also pertain to voices suggesting that auditory and visual information may interact to influence attractiveness judgements. It remains unclear whether interactions between auditory and visual modalities on perceived attractiveness occur and whether these are maintained across different ages of stimuli and participants. The aim of this study was to compare perception of attractiveness by adults ranging in age from 18-85yrs using a similar range of ages in face and voice stimuli. Visual, auditory and audio-visual stimuli were used. The task was to rate the attractiveness of the face (Experiment 1) or voice (Experiment 2) and also to guess the individual’s age. Finally, in Experiment 3, voices and faces were shown simultaneously (AV condition) and were either congruent or incongruent for age. It was expected that the perceived age of the stimulus would affect its attractiveness and that younger faces and/or voices would result in higher ratings in multisensory stimuli. I found that younger stimuli were preferred across all modalities by all age groups. Furthermore, older participants gave significantly higher ratings to faces. In Experiment 3, AV congruent stimuli were rated significantly more attractive than incongruent ones, but there was a clear preference for bimodal stimuli which included younger faces. Participants were also more accurate at guessing the age of the face than the voice. These findings suggest that vision dominates in the
4.0 The role of age of stimulus and age of participant on evaluation of attractiveness

perceived attractiveness of others and that attractiveness may be related to greater perceptual ‘fluency’ in the visual domain.

4.1 Introduction

Daily we are exposed to innumerable commercial products and promises aimed at increasing our attractiveness. The most typical message found across all of these is that to remain attractive we must remain youthful looking. Although there is evidence to suggest that media messages like this do influence purchasing habits and perceptions of what is or is not attractive (Barber 1998), what shapes our perception of age and attractiveness appears to be less simplistic.

Perhaps the most obvious and unavoidable change as we age is how we look. These changes have differing impacts on how attractive we are perceived to be and how it impacts others’ behaviour towards us. Early studies on the subject indicated that attractive male and female adults were evaluated more positively, perceived to be more socially desirable and receive favourable treatment (Dion, Berscheid & Walster, 1972; Langlois et al, 2000). Surprisingly this favourable behaviour towards attractive individuals appears to start very early in life.

For example, Berkowitz & Frodi (1979) found that females punished unattractive children who were unfamiliar or unrelated to them more harshly than attractive children, even though the children were engaging in exactly the same behaviours. Langlois et al. (1995) found that an infant’s attractiveness influenced how they were treated by their mother. Using a large sample of new-borns and 3 month olds, they established that mothers whose children were considered to be attractive were more affectionate and playful towards their children compared to mothers whose children
were perceived as less attractive. They also found that mothers of less attractive infants were more likely to give attention to other peoples’ children than their own and more likely to engage in simple routine caregiving rather than affectionate behaviour toward the unattractive child. A number of other studies have also highlighted the difference in parental treatment of attractive versus unattractive children from children born with physical anomalies (Allen, Wasserman & Seidman, 1990), and also to the treatment of attractive versus unattractive daughters during the Great Depression in 1930’s America (Elder, Van Nguyen & Caspi, 1985).

Contrary to these findings some studies have indicated that infants themselves may already be hardwired to show preferences for attractive adult faces. Although studies differ on exactly when it emerges, young infants have been shown to display a preference for human like face configurations from just a few hours to a few months of age (Jonhson et al., 1991; Mondloch et al, 1999). Indeed many studies have noted that from very early on infants have the ability to discriminate many complex characteristics of faces such as gaze direction (Farroni et al., 1995), emotional expression (Field et al., 1982) and identity (Pascalis & de Schonen, 1994). It is perhaps therefore unsurprising that Langlois et al. (1987) demonstrated that adult faces rated as being attractive by adult raters drew longer viewing times from 2-3 month olds than unattractive faces. In a follow up study Langlois et al. (1991) demonstrated that this preference was generalized across faces of different genders, races and ages. Van Duuren, Kendell-Scott & Stark (2003) even demonstrated infant looking-preferences for similarly aged attractive infant faces.
Despite evidence to suggest that infants are able to compile an average of multiple faces, deHaan et al. (2001), and Rhodes et al., (2002) demonstrated that infants did not share the same preference for averaged or symmetrical faces that adults did. In their experiment Rhodes et al showed pairs of faces to infants that differed in their averageness or symmetry and found that in contrast to their parents, infants spent more time looking at the less average or less symmetrical faces. They suggested, however, that this preference was more likely as a result of a novelty preference rather than an overall aesthetic preference.

While it is clear that although possessing attractive features early on in life is enough to influence other's perception and behaviours towards us, such features are not likely to remain stable due to the large changes in physical proportions as we grow older as well as hormone level changes throughout the life span. Several studies have investigated whether or not attractive children are likely to grow into attractive adults. Studies by Alley (1993), Zebrowitz, Olson & Hoffman (1993), and Pittenger, Mark & Johnson (1989) found that there did appear to be some stability in attractiveness ratings from childhood to adulthood. Cornwell (2005) found that the stability in attractiveness was more likely to occur in females rather than males because for males the relationship between masculinity and attractiveness changes. Masculinity is unattractive in young male children but becomes increasingly attractive as the person ages. Harrison et al. (2011) argued that these studies tended to use older children and not young infants. In their study, Harrison et al showed photographs of infants (aged 3-18 months) and photographs of that same individual as an adult (approx. 18yrs) to participants and asked them to rate the photos for attractiveness. They found that overall infant photos were rated as being more
4.0 The role of age of stimulus and age of participant on evaluation of attractiveness

attractive than adults to all raters, regardless of gender, however there was no significant correlation between attractiveness ratings for infant photos and attractiveness for that same individual as an adult suggesting that the features used in making these judgements do not remain stable over time.

While ageing does appear to influence how attractive we are perceived to be, not all individuals seem to age at the same rate where often a person can appear to look older or younger than their actual biological age. In a study of college-aged adults between 21-23 years of age, Law-Smith (2006) asked participants to guess the age of the faces. Guessed ages ranged between 19-27 years of age, a substantially wider range than the actual ages of the faces. Perrett (2010) proposed that differences in how we age are as a result of a combination of environmental and genetic factors and that this affects not only how attractive we are perceived to be but also may be a good indicator of longevity in general. Faces that were made to look more masculine were guessed to be older than they actually were while faces made to look more feminine looked were guessed to be younger than they actually were (Perrett et al., 1998). Similarly Bulpitt et al. (2001) found that males were perceived to be older than identically aged females in their study. Boothroyd et al. (2005) suggest that these results are perhaps not unsurprising where male life expectancy overall is shorter than female life expectancy with masculine features indicating quicker ageing.

There are many physical changes that occur during the life span that also give rise to changes in attractiveness. Perhaps the most obvious change in visual features as we age is that of hair and skin, however, many more subtle changes occur that impact on our attractiveness. Fuller and redder lips in younger adults give way to paler and
4.0 The role of age of stimulus and age of participant on evaluation of attractiveness

thinner lips as overall blood supply to the lips reduces. Changing hormone levels as we age mean that weight is distributed to the body differently than at younger ages impacting negatively on features like waist-to-hip and waist-to-chest ratios. Furthermore the cartilage in features such as nose and ears continues to grow as we age making those features appear bigger in proportion to the rest of the face. While it is possible to mitigate the impact of some of these on our perceived attractiveness, Perrett (2010) found that perceived age was determined by the oldest looking feature of the face. In their experiment they manipulated images of younger and older female faces matched with younger or older looking hair. There was no decrease in guessed age for older faces with younger hair but, conversely, younger faces paired with older hair were in fact perceived to be older than they actually were.

While it is clear that ageing does have an impact on how attractiveness is evaluated and that the age of the perceiver also may have a role, much of what we understand about ageing and attractiveness evaluations has been derived from studies using narrow age samples of both participant and stimuli, or having made use of edited stimuli that do not reflect a natural ageing process.

In the current study I aim to address some of these shortcomings and examine how faces and voices are evaluated for attractiveness by three different age groups of participants evaluating three similarly aged groups of stimuli. Establishing what, if any, differences are made for evaluating different ages of participant and stimuli will allow for a greater understanding of how different features contribute to attractiveness judgements across a wider age span.
4.2 Experiment 1

4.2.1 Introduction

One of the main findings in studies on age and attractiveness is that younger stimuli tend to be rated as being more attractive than older stimuli. However, the majority of these studies have drawn their responses from young adult participants. It is unclear whether this pattern of results is applicable to older adults in their evaluations of attractiveness or if the age of the participant affects how they perceive attractiveness. The aim of Experiment 1 was to compare perception of attractiveness for faces of different ages given by adult participants of different ages. We asked three age groups of participants to rate a similar range of face stimuli to determine what, if any, difference may be caused by the age of the participant or the age of the stimulus.

4.2.2 Method

Participants

A total of 42 participants took part in this experiment with an age range from 21-86 years of age (26 female, 16 male mean age 42.8 years, SD=18.6). For subsequent analysis participants were subdivided into three age categories: Younger Adults (YA) 18-29 years, Middle aged adults 30-49 years (MA) and Older Adults (OA) 50+ years. The 14 YA participants consisted of 10 females, 4 males (mean age 26.2 years SD=2.7); The 16 MA participants consisted of 9 females, 7 males (mean age 37.7 years, SD=5.7); and the 12 OA consisted of 7 females, 5 males (mean age 69.2 years, SD=9.4). Participants were recruited from an exhibition held at the 'Science Gallery', from the School of Psychology in Trinity College Dublin and from a number of active retirement
The role of age of stimulus and age of participant on evaluation of attractiveness centres. Some of the participants received research credits for their involvement for Psychology students in Trinity College Dublin. Participants were instructed as to the task and provided written consent before taking part in the study.

Apparatus & Stimuli

The stimuli were presented on a colour LCD monitor (1,024 x 768px) at 60Hz refresh rate and the experiment was programmed using Presentation software running on a 2.1Ghz PC with 1GB RAM. Responses were recorded via a numberpad on a standard PC keyboard.

The face stimuli used in this experiment comprised a set of images of 128 unfamiliar faces, including 64 female and 64 male faces. Faces ranged in age from 18 to 88 years of age. These stimuli were taken from ‘The Center for Vital Longevity Faces Database’, from the University of Michigan. Initially stimuli were divided into four age categories for testing, (18-35yrs; 35-50yrs; 50-65years; 65+years, each contained 16 male and 16 female faces), however subsequently participant analysis was based on the three age groups outlined above due to difficulty in matching older adults participants for the older adult stimuli sets for the 50-65 and 65+ years. Consequently the number of stimuli presented in the older adult group was larger than the younger and middle aged stimuli groups, the potential impact of this is discussed later.

All face images were shown with a neutral expression, were facing forward with eye gaze straight ahead. Photo images were unedited (i.e., included hairstyles) and presented on screen at 320x400 pixels which subtended visual angles of 7.62° horizontally and 9.52° vertically at a distance of 60cm from the screen.
4.0 The role of age of stimulus and age of participant on evaluation of attractiveness

Design & Procedure

The experiment was based on a two-factor, mixed design with age of participant (YA, MA, OA) as the between subjects factor and age of face stimulus (Y, M, O) as the within subjects factor.

Participants were seated in front of the screen at a distance of 60cm and given on screen instructions about the task. The experiment consisted of one continuous block of trials where participants viewed a face on screen and immediately answered two questions about the face they had just seen. Faces were presented for 1 second each and participants were asked to rate the face for attractiveness using a 7 point scale where 1 was 'very unattractive' and 7 was 'very attractive'. Participants were encouraged to use as much of the scale as possible and to answer as quickly as possible. They were also asked to guess the age of the face they had just seen. Trial order was randomised across participants. The question order was counterbalanced across participants. The next question or trial did not appear until the participant made a response.

4.2.3 Results

i) Attractiveness ratings:

The reliability of the attractiveness judgements was a computed using Cronbach's alpha and inter-rater agreement was high for attractiveness (.94). The inter-rater agreement among each of the age groups of participants was also calculated using Cronbach's alpha and was (.90) for young adults, (.91) for middle aged adults and (.94) for older adults.
The mean attractiveness ratings were calculated for each age group of the faces by the age of the participant, and are plotted in Figure 4.1. A mixed 3 (Age of Stimulus) x 3 (Age of Participant) ANOVA found a significant main effect of the age of face [F(2, 78) =20.61, p<.01, η²p=.34]. A Tukey post-hoc found that young faces were rated as more attractive than middle aged and older faces, and that middle aged faces were rated as being more attractive than older faces (p<.0001). There was also a significant main effect of participant age [F(2, 39) =13.2361, p<.01, η²p=.40]. A Tukey post-hoc test revealed that older adults provided significantly higher attractiveness ratings than their younger or middle aged counterparts (p<.0001). No interaction between the age of stimulus and age of the participant was observed [F(2, 39) =.089, p<1].

Figure 4.1: Mean attractiveness ratings for age of face as rated by each age group of participants in Experiment 1. SE bars of the mean are shown.

To investigate whether the sex of the face had an effect on participants’ ratings a 3 (Age of Participant) x3 (Age of face) x2 (Sex of face) mixed ANOVA was carried out. A
The role of age of stimulus and age of participant on evaluation of attractiveness

Main effect of sex of the face was found \([F_{(1,39)}=11.191, p<.01, \eta^2_p=.22]\). An inspection of the means indicated female faces were rated as being more attractive than male faces. There was no interaction between the age of participant and the sex of the face \([F_{(2,78)}=1.07, p=.35]\). No other interactions were observed. These results are plotted in Figure 4.2.

![Figure 4.2](image)

**Figure 4.2:** Mean attractiveness ratings for age and sex of stimulus as rated by each age group of participant. SE bars of the mean are shown.

Finally, to see if the sex of the participant had any effect on the ratings of visual stimuli a between groups mixed ANOVA was carried out. Due to the differences in the number of male and female participants across each of the age groups, the ratings were collapsed across all age groups. No effect of participant sex was observed \([F_{(1,40)}=.004, p<1]\), see Figure 4.3.
4.0 The role of age of stimulus and age of participant on evaluation of attractiveness

Figure 4.3: Mean attractiveness ratings for age of stimulus as rated by female and male participants. No effect of participant sex was observed. SE bars of the mean are shown

ii) Guessed Age:

Overall, the mean guessed age for the face stimuli in each age category was consistent with the actual mean age of the faces (see Figure 4.4). A series of single sample t-tests were conducted to compare the guessed age of the face with the actual mean age for that face category. There was no difference between the guessed and actual mean age (26.5 years) for the younger faces \[t(41)=1.504, \ p=.14\]; nor between the guessed and actual mean age (42.5 years) of middle aged faces \[t(41)=-1.539, \ p=.131\]. However, the guessed age (mean of 60.12 years) was significantly younger than the actual mean age (69 years) of the older faces \[t(41)=-15.465, \ p<.001\]. This was likely due to the larger spread of ages in this category, 50-88 years of age, relative to the younger age categories.
4.0 The role of age of stimulus and age of participant on evaluation of attractiveness

Figure 4.4: Mean guessed age of each stimulus age group compared to the actual mean age of the stimulus age group. Overall participants mean guessed age was consistent with the actual mean age of the face group, with the exception of faces in the older age category.

4.2.4 Discussion

The aim of the current experiment was to examine how adults of different age groups would evaluate faces for attractiveness which were sub-divided into three different age groups. In line with the previous literature, the younger the face stimulus the more attractive it was rated. Specifically younger adult face stimuli were rated as being more attractive than middle aged faces which, in turn, were rated as being more attractive than older aged faces.

Interestingly the age of the participant influenced how the face was evaluated for attractiveness. Older adult participants gave significantly higher ratings of attractiveness to faces across all age groups over their younger and middle aged adult counterparts. Although there was no significant difference between how younger and middle aged adult participants evaluated the faces, the results shown in Figure 4.1
suggest that middle aged adults tended to give higher ratings of attractiveness than younger adults (although the difference was not statistically different).

Overall, participants were quite accurate at guessing the age of the unfamiliar faces presented. This high accuracy and the significant difference between the attractiveness rating for each age group of stimuli suggests that accurate age estimation is important in evaluations of attractiveness. Finally while there was no significant difference in how the sex of the participant affected responses, this may have been as a result of having to collapse male and female participant responses from all age groups. Further testing with a sufficient balance of male and female participants in each group may be useful in understanding if both the age and sex of the participant affect their evaluations.

4.3 Experiment 2

4.3.1 Introduction

While few studies have directly addressed the effect of age of participant and stimulus on perception of attractiveness in the visual domain, fewer still have addressed this question outside the visual domain. In Experiment 2 I aimed to address the same questions outlined in Experiment 1 but through vocal only information. Here I presented three age groups of participants with three age groups of vocal stimuli and asked them to rate the voice they had heard for how attractive they found it. No visual information was presented here.

4.3.2 Method

Participants
4.0 The role of age of stimulus and age of participant on evaluation of attractiveness

A total of 36 participants took part in the current study (22 female, 14 male mean age 42.03 years, SD=21.26), these participants were a separate group from the participants in Experiments 1 and 3. Participants were recruited from an exhibition held at the ‘Science Gallery’, from the School of Psychology in Trinity College Dublin and from a number of active retirement centres. The participants were subdivided into three age categories: Younger Adults (YA) 18-29 years, Middle aged adults 30-49 years (MA) and Older Adults (OA) 50+ years. The 12 YA participants consisted of 7 females, 5 males (mean age 21.010 years SD=3.1), the 12 MA participants consisted of 6 females, 6 males (mean age 35.7 years, SD=5.06) and the 12 OA consisted of 9 females, 3 males (mean age 69.3 years, SD=7.8). Participants were instructed as to the task and provided written consent before taking part in the study.

Apparatus & Stimuli

The experiment was presented on a colour LCD monitor (1,024 x 768px) at 60Hz refresh rate using Presentation software running on a 2.1Ghz PC with 1GB RAM. Auditory stimuli were presented via a pair of Senheisser 205 headphones with the sound level pressure approximately 56dbA. Responses were recorded via a standard PC keyboard.

Voice stimuli used here were a subset of recorded voice stimuli from a number of visitors to a previous exhibition at the Science Gallery, approximately 180 individuals were recorded in total. All voice actors provided informed, written consent to have their voices recorded for the purpose of this experiment. The actors were instructed to say the following sentences: “The television is in the living room” and “There are trees in the forest” which were recorded in a quiet environment. These sentences
were chosen for being semantically neutral and the actors were instructed to state the sentences using a neutral vocal expression. The subset chosen for use here were clips that were free of external noise, spoken clearly and with fluent English. All but two voice actors were Irish in origin but these also spoke fluent clear English. There were 48 voice samples used in the current experiment, 24 female voice samples and 24 male voice samples ranging in age from 18 – 68 years. Each voice sample was presented for approximately 1.5 seconds in duration.

Design & Procedure

The experiment was based on a two-factor, mixed design with age of participant (YA, MA, OA) as the between subjects factor and age of face the stimulus (Young, Middle, Older) as the within subjects factor.

The experiment was conducted in a quiet testing lab. Participants were seated in front of a computer screen and given on screen instructions about the task. The experiment consisted of one continuous block of trials, the order of which was randomised across participants. In each trial, participants listened to a voice sample and immediately answered two questions about the voice they had just heard. Voices were presented for approximately 1.5 seconds each and participants were asked to rate the voice for attractiveness using a 7-point scale (where 1 was ‘very unattractive’ and 7 was ‘very attractive’). Participants were encouraged to use as much of the scale as possible and to answer as quickly as possible. They were also asked to guess the age of the voice they had just heard. The question order was counterbalanced across participants, and the next question or rating face did not appear until the participant made a response.
4.3.3 Results

i) Attractiveness ratings:

The reliability of the attractiveness judgements across raters was calculated using Cronbach’s alpha. Agreement was high among raters for attractiveness (.84), though this was not as high as the face only condition. Reliability among each of the age groups of participants was also calculated with results showing high Cronbach’s alpha of (.91) for young adults, (.88) for middle aged adults and less inter-rater agreement (.66) amongst older adults.

The mean attractiveness rating was calculated for each age category of the voice according to the age of the participant. The results are plotted in Figure 4.5. A mixed 3 (Age of voice, within subject) x 3 (Age of Participant, between subject) ANOVA was conducted on the attractiveness ratings. A significant main effect of the age of voice was found \([F(2,64) =28.54, p<.01, \eta^2_p=.47]\). A Tukey post hoc analysis revealed that younger and middle aged voices were rated as being more attractive than older voices. The effect of participant age failed to reach significance \([F(2,33)=2.6084, p=.08]\). There was no interaction between the age of voice and age of the participant observed \([F(2,33)= 1.07, p=.35]\).
4.0 The role of age of stimulus and age of participant on evaluation of attractiveness

To investigate whether the sex of the voices had an effect on participant’s responses a mixed 3x3x2 ANOVA was carried out. These results are plotted below in Figure 4.6.

No effect of sex of was found for voices \( F(2,33) = .2492, p = .62 \). There was no effect of age of participant on their ratings of male and female voice stimuli \( F(2,33) = 2.608, p = .089 \). No interactions were observed between any of the factors.

Figure 4.5: Mean attractiveness rating for each age of voice by the age of the participant in Experiment 2. SE bars of the mean are shown.

Figure 4.6: Mean attractiveness rating for each age of stimulus by the age of the participant by the sex of stimulus. SE bars of the mean are shown.
Finally, to see if the sex of the participant had any effect on the attractiveness ratings of the voice stimuli a mixed ANOVA was carried out. Due to the fact that male and female participant numbers were not equal across each of the age groups, responses from all age groups were collapsed. No effect of participant sex was observed \( [F(2,35) =1.374, \ p=.24]\). A main effect of the age of the stimulus was observe \( [F(2,34) =29.42, \ p<.001, \ \eta^2_p=.46] \). A Tukey post-hoc test found that older voices were rated as significantly less attractive then younger or middle aged voices \( (p<.05) \), there was no difference between younger and middle voices. No interactions between factors were observed.

![Figure 4.7: Mean attractiveness ratings for age of stimulus as rated by female and male participants. SE bars of the mean are shown.](image)

ii) Guessed Age:

The mean guessed age for each age group of the voice stimuli is plotted in Figure 4.8. A series of single-samples t-tests comparing the guessed age for young voice stimuli against the mean age for that category were conducted for each age category. First,
4.0 The role of age of stimulus and age of participant on evaluation of attractiveness

there was a significant difference between the mean actual age of the young voices (26.5 years) and the guessed age \([t(35)]=5.05, p<.01]\), with age overestimated. The guessed age for middle-aged voice stimuli differed from the mean age for that age category (42.5 years) \([t(35)]=-6.24, p<.04]\) with age underestimated. Finally, the mean guessed age for older voices was also significantly different from the mean age, \([t(35)]=-15.465, p<.001]\), with the age of the older voices underestimated relative to actual age.

![Figure 4.8](image)

**Figure 4.8**: Mean guessed age of each stimulus age group compared to the actual mean age of the stimulus age group.

4.3.4 Discussion

The current experiment aimed to examine how adults of different age groups would evaluate voices for attractiveness which were subdivided into three different age groups. Similar to the results in Experiment 1, younger voices were preferred over older voices for attractiveness. However, unlike Experiment 1, there was no significant difference between how each age group of participants evaluated those voices.
From the graph in Figure 4.5 it appears that Younger participants were similar in their evaluation of voices as they were with faces, with a steady decrease in attractiveness ratings as the age of the voice increased. The patterns for middle aged and older participants were not as consistent as previously found in the visual condition.

Compared with the vision only experiment, participants here were worse at guessing the age of the voice with all participants tending to underestimate the actual age of the middle aged and older stimuli and overestimating the age of younger stimuli, see Figure 4.8. Although older voices were rated as less attractive than either of the other two sets of voices, the lack of a significant difference in attractiveness between younger and middle aged stimuli may suggest that accurate age estimation is important in making a judgement of attractiveness. The lack of any clear participant group differences compared to the visual condition may also be a reflection of poor age estimation.

4.4 Experiment 3

4.4.1 Introduction

In this experiment I sought to extend our understanding of how ageing affects attractiveness perception by using bimodal stimuli. As the vast majority of studies examining attractiveness tend to focus on visual information, especially the face, I was interested in how additional sensory information, specifically vocal information would influence the perceived attractiveness of a face. Voice and face information were presented simultaneously to the participant and I asked them to rate the face for how attractive they found it to be. Faces were presented with voices that were congruent or incongruent with the age of the face to determine if the age of the voice
would also affect how a face was evaluated, for example would a younger voice paired to an older face enhance its attractiveness.

4.4.2 Method

Participants

A total of 51 participants took part in the current study (32 female, 19 male; mean age 42.8 years, SD=17.31), this group of participants did not take part in either Experiment 1 or 2. Participants were subdivided into three age categories: Younger Adults (YA) 18-29 years, Middle aged adults 30-49 years (MA) and Older Adults (OA) 50+ years. The 18 YA participants consisted of 11 females, 7 males (mean age 26.1 years SD=3.1); the 19 MA participants consisted of 12 females, 7 males (mean age 40.4 years, SD=6.21) and the 14 OA consisted of 9 females, 5 males (mean age 67.4 years, SD=6.88). Participants were recruited from an exhibition at the Science Gallery at Trinity College and from the School of Psychology (some received credits). Participants were instructed as to the task and provided written consent before taking part in the study.

Apparatus & Stimuli

The experiment was presented on a colour LCD monitor (1,024 x 768px) at 60Hz refresh rate using Presentation software running on a 2.1Ghz PC with 1GB RAM. Voice stimuli were presented via a pair of Senheisser 205 headphones with the sound level pressure approximately 56dbA. Responses were recorded via a standard PC keyboard.
Face images used consisted of 8 female and 8 male faces aged between 18-35 years and 8 female and 8 male faces aged between 50-65 years. These images were a subset of the images used in Experiment 1. Photos were unedited (i.e., hairstyle included) and presented on screen at 320x400 pixels which subtended visual angles of 7.62° horizontally and 9.52° vertically at a distance of 60cm from the screen. Voice samples consisted of 8 female and 8 male clips aged 18-35 years and 8 female and 8 male clips ages 50-65 years. Voice sample clips were the same sentences used in Experiment 2.

Bimodal stimuli were created by pairing voices with faces in a pseudo-random manner: faces and voices were always matched for sex. Otherwise the bimodal stimuli consisted of age-matched and age-unmatched face and voice pairs. Congruent matched pairs comprised of for example, young face/young voice and incongruent matched pairs comprised for example, older face/younger voice. For each age group of face stimuli 8 female and 8 male faces were presented with a congruent voice and an incongruent voice, this resulted in there being 16 congruent and 16 incongruent face/voice pairings for young face stimuli and older face stimuli. During presentation face and voice pairings were presented simultaneously for the duration of the voice clips, typically 1.5 seconds.

Design & Procedure

Participants were seated in front of a computer screen at a distance of 60cm and were first given on-screen instructions about the task. The experiment consisted of one continuous block of trials. In each trial, participants were presented with a face/voice pair. Participants were instructed to ignore the voice as best they could and base their subsequent judgements on the face they had seen. Immediately following the
bimodal stimulus, participants answered two questions about the stimuli they were presented. The stimuli pairs were presented for approximately 1.5 seconds each and participants were asked to rate the face for attractiveness (using a 7-point scale where 1 was 'very unattractive' and 7 was 'very attractive'). Participants were encouraged to use as much of the scale as possible and to answer as quickly as possible. They were also asked to guess the age of the face they had just seen. The question order was counterbalanced across participants, and the next question or rating face did not appear until the participant made a response.

4.4.3 Results

i) Attractiveness ratings:

The inter-rater reliability of these judgements was calculated using Cronbach's alpha. Inter-rater reliability was high suggesting high agreement across the ratings for attractiveness (.95). Reliability among each of the age groups of participants was also calculated with Cronbach's alpha of (.96) for young adults, (.94) for middle aged adults and (.91) for older adults, suggesting high agreement across ratings within each age group.

The mean attractiveness rating was calculated for each of the voice-age and face-age congruency conditions, according to the age category of the face (Y, O) and the age category of the participant (Y, M, O). These results are plotted in Figure 4.9. A 2 (Congruency, within subjects) x 2 (Age of Face, within subjects) x 3 (Age of Participant, between subjects) mixed ANOVA was conducted on participants ratings. This revealed a main effect of the congruency [F(1,48) =6.578 p=.013, \( \eta^2_p=.12 \)] with higher attractiveness ratings to age congruent face/voice pairs than age incongruent
face/voice pairs. There was a significant main effect of face age \( [F(1, 48) = 26.94, \ p < .01, \ \eta^2_p = .35] \) with bimodal stimuli containing younger faces rated as more attractive than older faces \( (p < .0001) \). There was also a main effect of participant age \( [F(2, 48) = 6.610, \ p < .002, \ \eta^2_p = .21] \), with older adults giving higher ratings than their younger counterparts. No interaction between the age of stimulus and age of the participant was observed. No other interactions were observed.

To investigate whether the sex of face had an effect on participants responses a 2x2x2 ANOVA was carried out. A main effect of sex of face was found \( [F(2, 48) = 6.578, \ p = .01] \) with females rated as more attractive than males. There was no interaction between the age of the participant and the attractiveness ratings of male and female stimuli.
The role of age of stimulus and age of participant on evaluation of attractiveness

To investigate if the sex of the participant had any effect on the ratings of audio-visual stimuli, a between groups mixed ANOVA was carried out. Due to the uneven distribution of male and female participants in each age group of participants, responses for all male participant were compared against responses for all female participants. No significant effect of participant sex it was observed \[F(1, 49) = 3.09, p=.08\].

![Figure 4.10: Mean attractiveness ratings for age of stimulus as rated by female and male participants. SE bars of the mean are shown](image)

ii) Guessed Age:

The guessed age was compared to the actual mean age of the face in each of age-congruent conditions using a series of single sample t-tests. No significant differences were observed between the guessed and actual age of the face in either of the congruency conditions (see Figure 4.11) at a 95% confidence level. Guessed ages for congruent and incongruent stimuli closely matched the mean age of the face.
4.0 The role of age of stimulus and age of participant on evaluation of attractiveness

presented. This suggests that age-incongruent voices did not interfere with the guessed age of the face.

![Figure 4.11: Mean guessed age of each stimulus age group compared to the actual mean age of the stimulus age group.](image)

Vision Only Comparison:

To establish whether the addition of voice or its age had an influence on how faces in the AV condition were evaluated, a series of Spearman's correlations were carried out comparing them to ratings from the Vision only results in Experiment 1. Ratings given to younger faces in Experiment 1 were compared to ratings given to younger faces in Experiment 3 for both congruency conditions, this was also done for older faces. The outcome in Table 4 below show that there were no significant correlations between ratings given for faces in the Vision only condition and faces that were presented simultaneously with younger or older voice information in the AV condition.
4.0 The role of age of stimulus and age of participant on evaluation of attractiveness

Table 4: Correlations for ratings of faces made in the Vision only and AV conditions. No significant correlations with Vision only ratings were evident for either congruency conditions in the AV condition.

<table>
<thead>
<tr>
<th></th>
<th>Vision Young</th>
<th>AV Congruent Young</th>
<th>AV Incongruent Young</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vision Young</td>
<td>1.0</td>
<td>0.03</td>
<td>0.11</td>
</tr>
<tr>
<td>Vision Older</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AV Congruent Older</td>
<td></td>
<td>0.10</td>
<td>0.16</td>
</tr>
<tr>
<td>AV Incongruent Older</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.4.4 Discussion

The aim of Experiment 3 was to investigate how participants of different ages would evaluate face and voice pairs for attractiveness by asking them to rate the face for attractiveness when it was presented with an aged matched voice (congruent) or an age mismatched voice (incongruent). The results showed that younger stimuli were preferred and that congruent face/voice pairs were rated as being more attractive than incongruent pairings for example there was no benefit for pairing an older face with a younger voice in order to try and increase its appeal. Similar to the results found in Experiment 1 older adults gave significantly higher attractiveness ratings overall compared to younger adults.

This experiment also aimed to establish if the presence of the vocal information influenced how the face was rated compared to being rated by itself. Were there to be no difference in how faces were rated in the presence of vocal information we would expect to see a high correlation between ratings given in the Vision and AV conditions. The lack of significant correlations observed between these ratings may indicate that faces were evaluated differently in the presence of simultaneously...
4.0 The role of age of stimulus and age of participant on evaluation of attractiveness

presented voice information. Although it was difficult to draw firm conclusions, the slight difference between correlations between the Congruent and Incongruent compared to the Vision only may suggest that the age of the voice also affected how the face was evaluated.

4.5 General Discussion

This aim of the series of experiments described in this chapter was to investigate how adults of different ages would evaluate sets of faces, voices and face-voice combinations for attractiveness. In Experiment 1 three separate age groups of adults rated three age groups of faces for their perceived attractiveness. The results found that younger faces were preferred by all age groups of participants. Also, older adults gave higher ratings for faces overall than their younger counterparts. In Experiment 2 participants were asked to rate the attractiveness of voices of different ages. Although younger voices were preferred to older voices, but there was no difference between the age groups of participants on how they evaluated the voices. Finally, in Experiment 3 participants were asked to judge age-congruent and age-incongruent face/voice pairs for attractiveness. Similar to the previous two experiments stimuli which contained younger faces were preferred. However, age-congruent pairings of faces and voices were rated as more attractive than incongruent pairings. Similar to Experiment 1 this experiment also found a difference between younger and older adults in how they evaluated the stimuli with older adults giving higher ratings overall.

The results here established that there is a significant difference in how adults evaluate the attractiveness of faces as they age. However there is insufficient direct evidence to explain why. Despite this it may be possible understand the likely reason,
4.0 The role of age of stimulus and age of participant on evaluation of attractiveness

with the main difference between groups being primarily their age, this can at least allow us to conclude that they have accrued different amounts of experience of attractiveness evaluation both of others and themselves. Specifically the older an adult becomes the more experience they have with evaluating attractiveness at different ages in their life relative to their own. A number of studies have found that an individual's self-perception can influence what they seek in potential partners. Bereczkei et al. (2007) and Waynforth & Dunbar (1995) showed a relationship between self-perceived attractiveness and preferences for others. In their studies they analysed the wording of ‘lonely hearts’ advertisements and found that females who made positive claims about their own attractiveness were more likely to make specific demands about potential male partners such as wealth or status than females who made no such claims. Similarly they found that males who offered positive claims about their wealth or status also made higher demands of potential female partners in terms of physical attractiveness than did males who offered no such clues. Little et al. (2001) demonstrated that where there was a positive correlation between a female’s self-perceived attractiveness and a preference for symmetry and masculinity in male faces. Additionally it has been established that preferences in attractive perception are adaptable and not necessarily pre-determined. For example, Tovee et al. (2006) observed changing attractiveness preferences for South African Zulus who had moved to the UK. They demonstrated that initial preferences for certain features of UK and Zulu participants were markedly different: for example, for high and low body mass, the UK participants preferred a lower body mass index than their Zulu counterparts. After living in the UK for some time Zulu participant preferences
changed more towards the local UK preferences showing that perception of attractiveness was malleable depending on exposure. Furthermore, they showed that Britons whose origins were African but who were born and raised in the UK had identical preferences to UK natives showing that norms of attractiveness perception can be modified depending on context and exposure and are not necessarily rooted in evolutionary mechanisms. Where age and self-perception of attractiveness are concerned, the more we age the more time we have spent observing our faces and observing the changes that occur. However our perception of attractiveness for our own face is not an absolute value and is likely to shift as these features change. A number of studies have also indicated that we are better at recognising faces of our own age which may impact how we evaluate them. Wiese, Schweinberger & Hansen (2008) demonstrated that younger adults were worse at recognising faces of older adults compared to younger faces, but that older adults were equally good at recognising both younger and older faces. Bruce & Young (2012) argued that expertise in face perception also changes as a function of age. For example our ability to recognise other 18 year olds is advantageous at the age of 18, but as we age we no longer need the ability to differentiate to recognise faces of that age and so become better at recognising faces of our current age.

An older adult will have had more opportunity to adapt their self-perceived attractiveness in light of changing features such as skin texture, tissue elasticity or symmetry. Despite these features pulling their attractiveness away from the average the relatively slow rate at which they occur should not have an immediate negative impact on self-perceived attractiveness. Consequently we are still likely to have had many “I look good today” moments across differing ages and differing levels of
attractiveness. Visually attractive features which are considered important in youth, such as symmetry or skin texture, may become less important as we age because these begin to naturally change and move away from their original younger configurations. A younger adult will not have accrued or incorporated as many of those “I look good today” moments and will not have adapted to consider deviations from the average caused by ageing into their self-perceived attractiveness. Several other studies have also highlighted older adults expressing less concern about their appearance and age related changes, even gaining in self-esteem about such issues, compared to their younger counterparts, (Ferraro et al., 2008; McMullin & Cairney, 2004).

The higher ratings of attractiveness for stimuli of all ages given by older adults in the face-only and face-voice experiments may reflect their ability to find all age groups attractive as a result of having to adapt to their own attractiveness across the life span. The tendency for middle age adults to also give higher ratings than younger adults may also be a reflection of this effect. Clarker & Korotchenko (2011) also suggest that shifting cultural preferences may lead to different evaluations by different age groups. For example, a recent trend towards a more muscular physique in males may cause younger adults to express dissatisfaction in evaluation of a physical appearance not conforming to that trend compared to their older counterparts who may not have internalised such preferences.

The absence of this effect in the auditory condition may be due to the nature of how the voice itself is perceived. While we are accustomed to looking at our own faces in the mirror which gives an accurate representation of what the face actually looks like,
4.0 The role of age of stimulus and age of participant on evaluation of attractiveness

albeit a reversed image, the stimulus is passive and does not require active output. Voices however are not passive and require energy for production. This energy in the form of vibrations across the larynx and into the head interferes with our ability to accurately perceive our voices the way others do as evidenced by the reaction we often have to hearing our voices on a recording. Whilst attractiveness appears to be predominantly visual in nature, self-perceived voice attractiveness may not normally be considered or attended to in the way facial attractiveness would be. Therefore this would not necessarily produce “I sound good today” moments across the life span which in turn may have led to inconsistent results seen in the voice-only experiment. Additionally the poor performance at guessing the correct age in the auditory experiment may also have affected evaluations, as discussed below.

While some of the results across all three experiments are broadly in line with previous studies the results for the audio condition in Experiment 2 differ both from this body of research and indeed some of the results of Experiments 1 and 3. Although there was a clear preference for youthful voices over other ages there was no evidence to suggest that adults of different ages evaluated voices differently for attractiveness as they did with faces from Experiments 1 and 3. From Figure 5 it appears that older voices were evaluated by all age groups in a similar fashion to the face-only and face-voice conditions, although the patterns for younger and middle age voices were not as consistent.

Several studies have previously highlighted people’s ability to correctly identify the age of a person based only on their voice. For example, a study from Ptacek & Sander (1966) demonstrated that participants were highly accurate at discriminating
between younger voices (<35 years) and older voices (>65 years). Bruckl & Sendlmeier (2003) further showed that participants estimated age for voices between the ages of 20-87 years were highly correlated with the actual age of the voices. Results from Experiment 2 indicate that participants were not as good at guessing the mean average age of the voice compared to estimating the age of the face in Experiment 1. There was a tendency to overestimate the age of younger voices and underestimate the age of older voices. A recent study by Sandmann et al. (2014) using a similar age range of voice stimuli also found a tendency for participants’ estimates of the age of voices to gravitate towards middle age: with increasing voice age the mean guessed age dropped and vice versa. While it is difficult to determine from these results why this might be the case, the results observed in the current study as well as the recent one by Sandman et al, suggest that people may not be as consistently accurate at estimating the age of a voice as other studies have suggested. This difficulty in accurately estimating the age is likely to impact on how the voice is evaluated for attractiveness, although a significant preference for younger voices was observed in this experiment, it was less powerful than the same effect observed for faces. The lack of a significant difference between participant groups in this experiment compared to Experiments 1 and 3 may have been as a result of this difficulty in accurately guessing the age.

The fundamental question of the current studies was to examine how ageing affected attractiveness perception. While it was possible to address this with the three age groups of participants and stimuli, the broad age categories did not allow for a more comprehensive examination of when such differences may begin to occur and at what rate they change. As well as the practicality of time constraints on testing and the
number of stimuli available, the basis for choosing the age categories of participants used here was each that group was broadly representative of what are normally considered, younger, middle aged and older adults. However each category spanned an age range from 12 to 20 years and above. The visual and auditory changes occurring across an age category (e.g. 18-30 years of age), or even from the end of one age category to start of another one can be quite significant in terms of signals used to judge attractiveness. For example the attractiveness rating for an 18 and 29 year old face are likely to be affected by changes in features like weight distribution, hair colour, skin texture or skin elasticity during that period, meaning that the responses for a single age category of stimuli could potentially be quite broad. Similarly voices are likely to be affected by things like hormonal changes affecting the length of the larynx or even lifestyle choices such as smoking. Using smaller age categories (e.g. 5 years), could potentially help mitigate the impact of some of these factors.

Although the findings in Experiment 2 differ from what is known about voices and guessed age, many other studies have shown people are able to estimate features such as age, height, weight etc. of a person based on the voice with a similar accuracy to that of pictures (Krauss, Freyburg & Marsella, 2002). In the audio-visual Experiment 3, a substantial difference in stimuli ages was used in the incongruent condition of approximately 30 years, it is perhaps therefore unsurprising that a main effect of congruency was found. While the results from Experiment 3 allow us to conclude that at least some congruency between the age of the face and the voice is important in attractiveness the use of such a wide age gap does not allow us to draw robust conclusions on how the face/voice information may be processed as we age with
regard to attractiveness decisions. While it is clear that there were no benefits or enhancement for an older face to be matched with a much younger voice, a closer age gap may reveal more about face and voice integration in perceived attractiveness.

Some studies have suggested that visual and vocal information are used for making different decisions about an individual, with visual information, such as the face, being used for likability or friendliness judgements and vocal information used to determine things like dominance and competence (Rosenthal et al., 1977). Furthermore Tigue et al. (2012) showed that politicians with lower pitched voices were perceived to be more dominant, attractive and likely to receive more votes than other politicians who were similar in facial attractiveness but whose voice had a higher pitch. Such results highlight the fact that both visual and auditory information about a person can have a strong impact on perceived attractiveness and other social judgements. It is possible that a tighter age grouping of face/voice congruency pairs in the current experiment could potentially allow us to observe whether or not some face/voice pairs interact to enhance or diminish its perceived attractiveness. For example a younger face paired with a voice five years older may benefit from sounding more dominant making the face more appealing.

In Experiment 3, the voice and face stimuli presented in each bimodal stimulus were not matched for identity (i.e., did not come from the same individual), therefore, to improve the understanding of face/voice interactions in attractiveness, it would be ideal to be able to pair faces and voices of the same individuals. Krause et al. (2002) found that participants were correctly able to match the voice of a speaker to the photograph of the person approximately 75% of the time. Kamachi et al. (2003) also
demonstrated that this could be done using dynamic stimuli even when there was a delay between presenting the face and voice. Other studies have illustrated that people can accurately infer other properties of a person from their voice such as weight or height (Krauss, Freyburg & Marsella, 2002). Although guessed age for voices in this study was poor it is possible that congruent pairings of face and voice could have been perceived as being incongruent to some degree where the features of the voice did not accurately reflect what was seen in the face (e.g., the weight of the person). As no information about the speakers, other than age and sex was available, it was not possible to match these kind of features as accurately as possible.

While there did appear to be a benefit for congruent audio-visual stimuli in Experiment 3 further conclusions about audio-visual interactions are difficult to draw due to the fact that both younger and older adults appear to rely predominantly on visual information when making judgements about face-voice pairings. It is probable that in the incongruent condition the participant simply ignored the vocal component when it became apparent that it was highly unlikely to belong to the face presented at the same time.

Finally, in addition to some of the reasons outlined here to explain varying evaluations of attractiveness by different age groups, it is difficult to discount the effect of changing sexual preferences and desires. Reproductive optimisation is more likely to factor into a younger adults evaluation of a potential partners attractiveness more so than older adults where this may not be a desired or even possible outcome. Although there has been a tendency to stereotype older adults as being somewhat asexual, (Walz, 2002), Got & Hinchliff (2003) pointed out that older adults still value sexual
activity in relationships but that the frequency and motivation changes as a result of
the changing nature of relationships (e.g., from passionate to companionate love).
Consequently the physical features considered to be desirable to one age group may
not necessarily be important to another.

4.6 Conclusions

The aim of this series of experiments was to examine what, if any, differences would
exist between how adults of different ages would evaluate visual, auditory and audio-
visual stimuli for attractiveness. In line with previous literature the results across all
experiments indicated that the younger a face or voice was the more attractive it was
perceived to be and this was evident for all age groups of participants. However the
results found here have shown that the age of the participant influences how
attractive a stimulus is perceived to be but only in the visual and audio-visual
conditions with older adults giving higher ratings to stimuli compared to younger and
middle age adults. While no such difference was observed for the auditory voice
condition, this may reflect a participant’s inability to accurately identify the age of the
voice which in turn may have affected attractiveness ratings. In the audio-visual
condition there was a preference for congruent stimuli pairs where the face and voice
were matched in age compared to age-incongruent pairs. This suggests that both
visual and auditory information are combined to make a judgement of attractiveness.
However when looking at the estimated ages in the audio-visual condition the lack of
any impairment in guessing the age of faces paired with mismatching voices suggests
that vocal information may be easily discarded by the perceiver leaving a decision
primarily driven by visual information. The large mismatch in ages used for the AV
condition do not allow us to infer at what point vocal information may be discarded
4.0 The role of age of stimulus and age of participant on evaluation of attractiveness

in preference for visual information. Although older adults did differ in their ratings
given to AV stimuli compared to the two younger groups, the overall evaluation of AV
stimuli by each group of participants was broadly similar.

These findings here have implications for practical applications where the appeal of
a person is important for engaging adults of different ages. Whereas these results
suggest that older adults may prefer a broader range of faces, younger adults
preferences appear to be much narrower and as such may require a more specific
type of stimulus if they are to find it appealing or engaging.
5.0 An investigation on the role of ageing in trait evaluations

Abstract

Every day we make rapid social judgments about individuals whom we may never have met before based on little more than a quick glance at a face or overhearing a few spoken words. A growing body of literature has found that inferring traits about others is found across all cultures and can be done extremely quickly. However the vast majority of these studies have drawn their responses from younger adult populations predominantly evaluating younger adult faces. Here I sought to investigate how the perception of a trait would change as a function of ageing and whether or not older adults would form similar trait impressions or if these would correlate in a similar way to those previously found in younger adult data. I also sought to examine how the age of the stimulus would affect how it was evaluated on specific traits by using three age groups of face images: younger, middle-aged and older adults. The results here have shown that the ratings for certain traits decline with the age of the stimulus and that older adults readily make similar trait judgements and that these correlate in a similar way to younger adults responses even under restricted exposure durations. Some of the correlations observed in the participants here were not as strong as those observed in some previous studies with younger adults suggesting that the evaluation of these traits may be affected by the age of the participant. Furthermore this study showed that some correlations were specific to the age group of stimuli.
5.0 An investigation on the role of ageing in trait evaluations

5.1 Introduction

Faces and voices provide an abundant volume of information about a person. From these sources of information it is possible to rapidly and accurately determine attributes such as the identity, age, sex, mood or even health of an individual (Bruce & Young, 1986; Krauss, Freyburg & Marsella, 2002; Schweinberger & Burton, 2011). Furthermore it is possible to use this information to inform our decisions about the person (e.g., how attractive we find them). Determining these various properties about a person from the face or the voice is often as a result of the physical properties of the stimulus itself. The identity of a person is based on a set of physical characteristics of the face or the voice that are, for the most part, unique to that person. However, common characteristics can be found in the perception of certain attributes such as age. A young face is more likely to be perceived as a result of the face possessing features such as larger eyes in proportion to the rest of the face, smaller nose, rounder cheeks etc. A voice is likely to be perceived as an older male as a result of that voice being lower in pitch or a having a certain timbre.

Often such physical features are easily quantified thus making it easier to predict an individual’s perception of properties such as age, sex etc. Although a quality such as attractiveness may seem to be more subjective on the part of the perceiver, a large body of research exists showing that attractiveness is highly tied to certain physical characteristics of the face (Perett, 2010; Valentine, Darling & Donnelly, 2004), and that perception of attractiveness is highly consistent among raters of different cultural backgrounds or influences (Apicella & Feinberg; 2007, Feinberg 2008). Perceiving certain properties, such as sex, age or attractiveness, are some of most common sources of information we extract from a face or a voice. However, it is
possible to make further complex decisions based on these same physical characteristics.

While perceiving the age or sex from a face is, seemingly, a simple matter and is dependent on the availability of certain physical properties in the image, we are also able to use this same information to determine other important social dimensions of a person. Inferring traits about someone when we first meet them is a common reaction often done quickly and effortlessly, (Ambady, Bernieri & Richeson, 2000; Willis & Todorov, 2006). There has been a long history of attempts in the literature to determine personality traits based on physical dimensions of the face. But early attempts at quantifying what types of traits people were likely to possess based on their physical characteristics were pseudoscience at best and often highly subject to the individual who was carrying out the experiments. Perhaps the most well-known version of this was known as 'phrenology' and was popular during the nineteenth century (Combe, 1843). Phrenology espoused a relationship between the physical dimensions of the skull and a person's social character. Physiognomy, although less well known, appears to have been present in some form in many ancient cultures and most often concerned determining traits about a person based on their appearance and in particular the face, (Oosterhof & Todorov, 2008). Although this too was often highly subjective, its use in so many cultures across such long periods of human history does strongly indicate that humans do in fact make social judgements about others based only on how they look or how they sound.

More formal and rigorous examination of these impressions began in the 1940s including the work of Asch (1948) who highlighted the speed at which impressions
5.0 An investigation on the role of ageing in trait evaluations

formed and how one trait may be related to another either positively or negatively. Since then this field of investigation has continued to grow. Of the most commonly studied traits, the perception of trustworthiness from faces has received a lot of attention in the literature (Dzhelyova, Perreft & Jentzsch, 2012; Todorov, Pakrashi & Oosterhof, 2009; Zebrowitz & Franklin, 2013). The nature of self-preservation makes this unsurprising, as being able to determine whether or not another person is trustworthy can have direct positive or negative consequences on our well-being and future survival. People’s ability to accurately determine who is and is not trustworthy has been shown to be surprisingly good. For example, in an experimental setting where some participants cheated or were uncooperative during a game, a separate group of participants, who were unfamiliar with those playing the game, were able to correctly identify these cheaters significantly above chance levels from only a photo of the person (Verplaetse, Vannest & Braeckman, 2007; Yamagishi et al, 2003). Judgements of trustworthiness have been shown to be made extremely quickly and are relatively stable over time. Todorov, Pakrashi & Oosterhof (2009) demonstrated that judgements of trustworthiness in a set of unfamiliar faces could be made after as little as 33msec exposure to each face image. Furthermore, these judgements were relatively stable even with unlimited viewing time with a plateau in the stability of these judgements coming after as little as 200msec. Such decisions can have important social impacts. Antonakis & Dalgas (2008) found that the initial impressions formed by voters about candidates based solely on their appearance were difficult to change and that this subsequently influenced their voting patterns. Todorov et al. (2005) also showed that positive inferences about a politician (in a US election), made
5.0 An investigation on the role of ageing in trait evaluations

after a 1 second exposure to their face, predicted their likelihood of being elected and was even linearly related to their margin of victory.

Some evidence suggests that the speed at which we make trustworthiness judgements is related to its importance to human survival and that automatic activations in the amygdala, where dangers or threats are processed, facilitate this very quick judgment (Cosmides & Tooby, 1992; Winston et al, 2002). However Willis & Todorov (2006) also demonstrated that judgments of other traits such as attractiveness, aggressiveness, likability and competence could also be made after as little as 100msec and that these also highly correlated with judgements given in the absence of any time limits.

Although facial information can change with expressions of emotion, interestingly, some research has suggested that trait judgements are not necessarily dependent on the expression of the face. For example a judgement of aggressiveness does not require the face to be displaying an angry expression, and many trait inferences can be easily made on non-expressive faces (Todorov et al., 2008; Zebrowitz & Montepare, 2008).

Trait inferences do not necessarily occur in isolation. Many studies have observed that certain traits can be correlated positively or negatively with other traits: for example attractiveness has been shown to be positively correlated with perceived intelligence (Kleisner, Chvátalová, Flegr, 2014). Conversely, perceived attractiveness of a face has been shown to be negatively correlated with facial distinctiveness, (Perrett et al., 1998).
5.0 An investigation on the role of ageing in trait evaluations

Voices have been described as the ‘auditory face’ (Belin et al., 2011), and communicate much of the same information about a person as is found in faces. Similarly to faces, traits can be easily and quickly inferred from the voice and are known to correlate positively and negatively with other traits in a similar way as those traits perceived from faces (Zuckerman & Driver, 1989). Prior to artificial lighting etc. voices were the only way to communicate after dark, and are unique from faces in their ability to communicate indirectly with another person as well as having the ability to change in loudness, inflection, emphasis, and can be used to communicate over a larger distance (Hughes, Harrison & Gallup, 2001). This fundamental difference with faces has likely led to differences in how voices are evaluated for traits compared to faces with some studies showing that faces are better used for inferring likeability or friendliness and voices better used for inferring dominance or competence (Rosenthal et al., 1977).

To date, the vast majority of studies involving trait perception have relied heavily on evaluations from younger aged adults (Hess, 2012), or only examined young adult faces (Castle et al., 2012). As a result much of what we understand about trait inference and correlation may be representative to this sample only. However, it may be important to consider how the perception of traits is determined across the lifespan, and whether the age of the face or voice affects the perception of certain traits. For example, a relatively small number of studies of faces from infants or children to adulthood have found that trait perceptions differ as changes in the face occur. Zebrowitz & Montepare (1992) found that younger faces were perceived as having more childlike traits, such as warmth or honesty but that the perception of these traits changed as the face matured.
A number of studies have indicated that face processing changes as a function of age. Germine, Duchaine & Nakayama (2010) pointed out that processes such as face learning are thought to peak prior to 35 years of age, and show age-related changes thereafter. Some studies have demonstrated differing levels of neural activity in response to faces in older adults, for example, reduced activation in response to angry faces when compared to younger adult neural activity (Fischer et al., 2005; Grady, 2008). Other studies have demonstrated that the increasing age of the participant resulted in lower rates of recognition for certain facial expressions or increased reaction times (Calder et al., 2003; Healey, Campbell & Hasher, 2008). While these studies suggest a decline in some aspects of face processing other studies have highlighted some interesting changes which may be relevant to trait perception.

A number of studies have illustrated a higher ability to recognise own-age faces as the person themselves ages (Anastasi & Rhodes, 2005; Harrison & Hole, 2009). Furthermore Wiese, Schweinberger & Hansen (2008) demonstrated that older adults were better at recognising faces of multiple age groups compared to younger adults, who were in turn, strongest at recognising faces from their own age group but not others. Bruce & Young (2012) argued that older adults have considerably more experience with ageing faces, including their own, but also a more enduring interest in faces of younger age groups through their children or grandchildren.

To help understand how trait perception from faces and voices changes as we age and to address the lack of studies which have looked at how older adults evaluate these traits, here I sought to establish how older adults perceive traits in faces and voices of differing ages. This study helped to establish whether or not similar trait
5.0 An investigation on the role of ageing in trait evaluations

correlations exist for older adult perceivers compared to what is already known. I also sought to understand how these traits are perceived for stimuli which represent different stages of adulthood. This study also allowed for a greater understanding of how ageing impacts each trait individually.

Specifically I sought to test how older adults evaluated faces and voices of different ages on attractiveness, competence, distinctiveness, dominance, familiarity and trustworthiness and how evaluation of these changes over the lifespan. These dimensions were chosen as they are some of the most commonly tested dimensions in trait perception, for which there is a large amount of data on how younger adults perceived these same traits (Bzdok et al., 2012; McAleer, Todorov & Belin, 2014; Kniffin & Wilson, 2004). Some studies have indicated that traits such as attractiveness decline with age, or that trustworthiness remains relatively steady, and that these perceptions can be subject to individual differences such as gender where non-physical traits, such as those measured here, more strongly influence perception in females than in males (Kniffin & Wilson, 2004; Sutter & Kocher, 2007).

5.2 Method

Participants

Thirty participants (17 female, 13 male) with a mean age of 71.86 years (SD = 6.74) volunteered to take part in this study. Their ages ranged from 57 to 87 years and all were recruited from an active retirement centre. All participants reported normal or corrected normal vision and normal hearing. Participants were instructed as to the task and provided written consent before taking part in the study. Participants received no compensation for taking part in the experiment.
Apparatus & Stimuli

All testing took place in a quiet room in a community centre. The visual stimuli for this experiment were presented on a colour LCD monitor (1,024 x 768px) at 60Hz refresh rate using Presentation software running on a 2.1Ghz PC with 6GB RAM. Auditory stimuli were presented via a pair of Sennheisser 205 headphones, at a sound level pressure of approximately 56dbA. Responses were recorded via a standard PC keyboard.

Face images:

The face images used as stimuli in this experiment comprised a set of images of 162 models, 81 male and 81 female. All images were acquired and used with permission from the 'Max Planck Institute for Human Development Berlin' FACES database. The 162 images comprised of the three adult age groups. Younger adult face images were aged between 19-31 years (27 male, 27 female) with a mean age of 24.3 years, SD = 3.5. Middle-aged adult faces were aged between 39-55 years (27 male, 27 female) with a mean age of 49.0 years, SD = 3.9. Older aged adult faces were aged between 69-80 years (27 male, 27 female) with a mean age of 73.2 years, SD = 2.8. All images of faces were identically lit, a uniform distance from the edge of the picture to the face and faces had a neutral expression. See Figure 5.1 for an example of the face stimuli used. No alterations were made to the original image (e.g., removal of external features). Face images were presented on screen at 480x600 pixels which subtended visual angles of 11.48° horizontally and 15.06° vertically at a distance of 60cm from the screen.
5.0 An investigation on the role of ageing in trait evaluations

Figure 5.1: An example of face stimuli featuring younger, middle aged and older adult faces

Voice clips:

A set of 60 voice clips was used as stimuli in the current experiment. Voices clips were divided into three age categories, each with 20 samples each for younger, middle aged and older adults with an age range from 19 – 68 years. Younger adult voices were aged between 19-31 years (10 male, 10 female) with a mean age of 23.1 years, SD = 4.3. Middle-aged voices were aged between 36-48 years (10 male, 10 female) with a mean age of 41.2 years, SD = 3.5. Older aged voices were aged between 55-68 years (10 male, 10 female) with a mean age of 61.5 years, SD=5.6. Voice stimuli were recorded from a subset of around 181 visitors to a Science Gallery exhibition and were recorded there in a closed booth to reduce noise. The subset was chosen based on
clips that were free of any external noise and clearly spoken, and some of these were the same clips used in auditory experiment in Chapter 4. All but two voices actors were Irish in origin but the remaining voices were clearly spoken and free from any strong, non-anglophone accents. The sentences “The television is in the living room” and “There are trees in the forest” were recorded from each volunteer. These sentences were chosen for being emotionally neutral and were spoken in a neutral manner. Each voice clip was approximately 1.5 seconds in duration. The voices were not matched for identity with the face images used.

**Design**

There were two main sessions to the experiment; a face session and a voice session, and each participant took part in both sessions. Of the six traits which were tested (attractiveness, competence, dominance, distinctiveness, familiarity and trustworthiness), participants were randomly assigned to two of these traits and were required to provide judgement ratings to both faces and voices on those two traits. It was not feasible to test each participant on all possible traits due to the length of time this would take as well as possibly introducing unwanted effects, such as the MEE, from having to present each face or voice six times. All possible pairwise combinations of the traits were used (a total of 15 pairs) across participants and the order of the trait questions were counterbalanced across participants. This resulted in the responses of ten participants per trait measured.

The face rating session of the experiment consisted of two parts, one for each cognitive dimension rated. Trials were divided into six separate blocks according to the age and sex of the faces. As such, each test block corresponded to one age group
and sex, (e.g., middle aged male faces). All six blocks were presented in a random order across participants. The face and blocks were repeated once for each participant. Participants first provided judgements according to one particular cognitive dimension (e.g., competence) to all faces, for the first six blocks. These blocks of trials were then repeated and participants were required to provide judgements according to a different cognitive dimension (e.g., trustworthiness) for the second set of six blocks. There were a total of 324 trials in the face condition. Following completion of the face session of the experiment, the participant was then asked to rate each of the voices on the same two cognitive dimensions as given for the faces.

Voice trials were presented in separate blocks according to the same design as the face condition. Voice clips were blocked by age and sex of voice. There were 10 clips in each block, 5 “The television is in the living room” and 5 “There are trees in the forest”. These were randomly presented and participants rated the voice on a single given dimension immediately after the presentation of the voice. Similar to the faces, each of the voice clips was presented again later and rated on another dimension. There were a total of 120 trials in the voice conditions. To facilitate completion of the experiment the longer face rating part of the experiment was presented prior to the voice rating.

Procedure

Each participants was seated in front of the screen at a distance of 60cm and given on-screen instructions about the task. In the face block of trials, a trial consisted of the presentation of an image of a face, followed by the trait question. Each face image
was shown for 1sec, and the question remained on the screen until the participant responded. Participants rated the given dimension ("How Trustworthy?") on a scale from 1 – 7 (where 1 = not very trustworthy and 7 = very trustworthy). After each block the participant was given the opportunity to take a self-timed break before proceeding to the next block of trials. Following the completion of the first part of the experiment, all six blocks were shown again under the same conditions but the question following the presentation of the face was changed to reflect a different trait.

Following completion of the visual part of the experiment, the participant was then asked to rate voices on the same two traits. For each face or voice presented, participants provided a rating along a given dimension on a scale from 1 – 7 (where 1 = not very trustworthy and 7 = very trustworthy). Participants were encouraged to use as much of the scale as possible. The entire experiment took approximately 30-40 minutes for each participant to complete.

5.3 Results

The average rating for each cognitive dimension was calculated across the face and voice stimuli per participant, according to the age of the stimulus (young, middle or older age). Inter-rater reliability was calculated for each dimension determined from the face or voice using Cronbach’s alpha. Agreement varied from low to high among raters to the face stimuli; for each of the traits with attractiveness (.84), competence (.70), dominance (.39), distinctiveness (.49), familiarity (.51) and trustworthiness (.59). For the voice stimuli, the inter-rater reliability of the judgements of each trait was also computed using Cronbach’s alpha. Agreement varied from low to high.
5.0 An investigation on the role of ageing in trait evaluations

among raters for each of the traits with attractiveness (.44), competence (.67), dominance (.76), distinctiveness (.62), familiarity (.51) and trustworthiness (.22). The agreement of the ratings across participants on some of these dimensions were quite low, for example dominance from faces, and these results are discussed in detail below.

Cognitive dimensions determined from the face:

The mean ratings for each of the 6 cognitive dimensions, according to the age of the face stimulus are presented in Figure 5.2. Firstly to establish whether or not there were differences in how each age group was rated on each dimension, separate, one-way repeated measures ANOVA were carried out on the ratings provided to each dimension. A significant effect of face age was found for attractiveness ratings \( F(1,9) = 22.28, p < .01, \eta^2_p = .71 \), a Tukey post-hoc test revealed that overall the young faces were rated as more attractive than middle aged faces, and middle aged faces were rated as more attractive than older adult faces (\( p < .05 \)). Similarly a main effect of face age was observed for competence, \( F(1,9) = 8.16, p < .01, \eta^2_p = .47 \). A Tukey post-hoc test found that older adult faces were rated as less competent than either younger or middle-aged faces, \( p < .05 \). No difference was observed between younger and middle aged faces on perceived competence. No main effect of face age was observed in the remaining trait dimensions.
5.0 An investigation on the role of ageing in trait evaluations

![Figure 5.2: Mean rating for each cognitive dimension across all participants, according to the age of the face stimulus. SE bars of the mean are shown. Attractiveness (Att), Competence (Comp), Dominance (Dom), Distinctiveness (Dist), Familiarity (Fam), Trustworthiness (Trust)](image)

The correlation was calculated between each individual dimension. There were significant correlations between the age of the stimulus and attractiveness $r(-.66)$, competence $r(-.30)$, familiarity $r(-.27)$ and trustworthiness $r(-.17)$. All were negative in direction indicating that as the age of the face increases, the ratings on these dimensions decrease. All traits are plotted against age in Figure 5.3.
I was then interested in investigating whether there was any relationship between the ratings provided across the different cognitive dimensions. To establish this, a series of Spearman’s correlations were calculated for each possible pairing of the cognitive dimensions. The results of these analyses are presented in Table 5.1 and the scattergrams are shown in Figure 5.4. Significant positive correlations (p<0.05) were found between the following dimensions: attractiveness & competence, r(.64) attractiveness & dominance, r(.25) attractiveness & familiarity, r(.63) attractiveness & trustworthiness, r(.56) competence & dominance, r(.43) competence & familiarity, r(.55) competence & trustworthiness, r(.55) familiarity & trustworthiness, r(.46). On the other hand, negative correlations were found between these dimensions: attractiveness & distinctiveness r(-.20), competence & distinctiveness r(-.20), distinctiveness & familiarity r(-.25), distinctiveness & trustworthiness r(-.25). There
5.0 An investigation on the role of ageing in trait evaluations

was no significant correlations between the remaining possible trait pairs. These results are summarised below in Table 5 and plotted in Figure 5.4.

**Table 5: Matrix of Spearman correlations between dimensions rated. Values marked in bold indicate where one trait is significant correlated with another (p<.05).**

<table>
<thead>
<tr>
<th></th>
<th>Att</th>
<th>Comp</th>
<th>Dist</th>
<th>Dom</th>
<th>Fam</th>
<th>Trust</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attractiveness</td>
<td>1</td>
<td>0.64</td>
<td>-0.21</td>
<td>0.26</td>
<td>0.63</td>
<td>0.56</td>
</tr>
<tr>
<td>Competence</td>
<td>0.64</td>
<td>1</td>
<td>-0.21</td>
<td>0.44</td>
<td>0.55</td>
<td>0.55</td>
</tr>
<tr>
<td>Distinctiveness</td>
<td>-0.21</td>
<td>-0.21</td>
<td>1</td>
<td>0.01</td>
<td>-0.26</td>
<td>-0.25</td>
</tr>
<tr>
<td>Dominance</td>
<td>0.26</td>
<td>0.44</td>
<td>0.01</td>
<td>1</td>
<td>0.13</td>
<td>0.07</td>
</tr>
<tr>
<td>Familiarity</td>
<td>0.63</td>
<td>0.55</td>
<td>-0.26</td>
<td>0.13</td>
<td>1</td>
<td>0.47</td>
</tr>
<tr>
<td>Trustworthy</td>
<td>0.56</td>
<td>0.55</td>
<td>-0.25</td>
<td>0.07</td>
<td>0.47</td>
<td>1</td>
</tr>
</tbody>
</table>

*Supplementary Analyses:*

All possible trait dimension pairs were analysed for correlations, separately and according to the age group of the face. Several significant correlations were observed for the different age group of the face which are presented in Tables 6 - 8. Interestingly while there was a high amount of overlap between some correlations in all age groups of the faces, the strength of these correlations changed depending on the age of the face stimulus. For example the correlation between attractiveness & competence appeared to become stronger as the face becomes older. However other trait pair correlations were found only in certain age groups of stimuli. Attractiveness & distinctiveness were not correlated in younger aged face stimuli, however, they became negatively correlated in middle aged face stimuli and the strength of that correlation increases for older aged stimuli.
Figure 5.4: Scattergrams of all the significant correlations observed between trait pairs in the visual condition. Each trait and its corresponding correlated trait are outlined on the X and Y axes of each plot with the rating scale of 1 – 7 for each trait at the origin point. Trend lines are marked in red.
Table 6: Matrix of correlations between pairs of traits across Young Aged face stimuli. Values marked in bold indicate a significant correlation (p<.05).

<table>
<thead>
<tr>
<th></th>
<th>Att</th>
<th>Comp</th>
<th>Dist</th>
<th>Dom</th>
<th>Fam</th>
<th>Trust</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attractiveness</td>
<td>1</td>
<td>0.28</td>
<td>-0.06</td>
<td>0.20</td>
<td>0.57</td>
<td>0.29</td>
</tr>
<tr>
<td>Competence</td>
<td>0.28</td>
<td>1</td>
<td>0.01</td>
<td>0.38</td>
<td>0.31</td>
<td>0.49</td>
</tr>
<tr>
<td>Distinctiveness</td>
<td>-0.06</td>
<td>0.01</td>
<td>1</td>
<td>-0.12</td>
<td>-0.13</td>
<td></td>
</tr>
<tr>
<td>Dominance</td>
<td>0.20</td>
<td>0.38</td>
<td>0.30</td>
<td>1</td>
<td>-0.07</td>
<td>0.10</td>
</tr>
<tr>
<td>Familiarity</td>
<td>0.57</td>
<td>0.31</td>
<td>-0.12</td>
<td>-0.07</td>
<td>1</td>
<td>0.45</td>
</tr>
<tr>
<td>Trustworthy</td>
<td>0.29</td>
<td>0.49</td>
<td>-0.13</td>
<td>0.10</td>
<td>0.45</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 7: Matrix of correlations between pairs of traits across Middle Aged face stimuli. Values marked in red indicate a significant correlation (p<.05).

<table>
<thead>
<tr>
<th></th>
<th>Att</th>
<th>Comp</th>
<th>Dist</th>
<th>Dom</th>
<th>Fam</th>
<th>Trust</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attractiveness</td>
<td>1</td>
<td>0.64</td>
<td>-0.29</td>
<td>0.24</td>
<td>0.54</td>
<td>0.66</td>
</tr>
<tr>
<td>Competence</td>
<td>0.64</td>
<td>1</td>
<td>-0.24</td>
<td>0.38</td>
<td>0.53</td>
<td>0.65</td>
</tr>
<tr>
<td>Distinctiveness</td>
<td>-0.29</td>
<td>-0.24</td>
<td>1</td>
<td>-0.06</td>
<td>-0.29</td>
<td>-0.32</td>
</tr>
<tr>
<td>Dominance</td>
<td>0.24</td>
<td>0.38</td>
<td>-0.06</td>
<td>1</td>
<td>0.11</td>
<td>0.11</td>
</tr>
<tr>
<td>Familiarity</td>
<td>0.54</td>
<td>0.53</td>
<td>-0.29</td>
<td>0.11</td>
<td>1</td>
<td>0.39</td>
</tr>
<tr>
<td>Trustworthy</td>
<td>0.66</td>
<td>0.65</td>
<td>-0.32</td>
<td>0.11</td>
<td>0.39</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 8: Matrix of correlations between pairs of traits across Older Aged face stimuli. Values marked in bold indicate a significant correlation (p<.05).

<table>
<thead>
<tr>
<th></th>
<th>Att</th>
<th>Comp</th>
<th>Dist</th>
<th>Dom</th>
<th>Fam</th>
<th>Trust</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attractiveness</td>
<td>1</td>
<td>0.73</td>
<td>-0.45</td>
<td>0.42</td>
<td>0.74</td>
<td>0.67</td>
</tr>
<tr>
<td>Competence</td>
<td>0.73</td>
<td>1</td>
<td>-0.46</td>
<td>0.51</td>
<td>0.69</td>
<td>0.44</td>
</tr>
<tr>
<td>Distinctiveness</td>
<td>-0.45</td>
<td>-0.46</td>
<td>1</td>
<td>-0.26</td>
<td>-0.41</td>
<td>-0.35</td>
</tr>
<tr>
<td>Dominance</td>
<td>0.42</td>
<td>0.51</td>
<td>-0.26</td>
<td>1</td>
<td>0.38</td>
<td>0.08</td>
</tr>
<tr>
<td>Familiarity</td>
<td>0.74</td>
<td>0.69</td>
<td>-0.41</td>
<td>0.38</td>
<td>1</td>
<td>0.47</td>
</tr>
<tr>
<td>Trustworthy</td>
<td>0.67</td>
<td>0.44</td>
<td>-0.35</td>
<td>0.08</td>
<td>0.47</td>
<td>1</td>
</tr>
</tbody>
</table>

Finally each trait dimension was examined with a between groups Mann Whitney U test to determine if male and female participants evaluated traits differently for each age of the faces shown. A significant difference was observed for competence, (U=2,
5.0 An investigation on the role of ageing in trait evaluations

$p=.033$), with male participants rating the faces as more competent than the female participants. No other significant differences were observed: attractiveness, $(U=12, p=1)$, distinctiveness $(U=10, p=.60)$, dominance $(U=6.0, p=.60)$, familiarity $(U=6.0, p=.20)$ trustworthiness $(U=5.5, p=.14)$. While these results indicate that older adult male and female participants evaluated the traits used here in a similar fashion, there does appear to be a trend for males to give higher ratings across all traits compared to females. The significant difference in ratings of competence suggest that certain traits may hold more power or be more socially relevant in an evaluation of a face depending on the sex of the perceiver. However due to relatively low number of male and female participants available it is difficult to draw firm inferences on why this may be the case. The mean rating given by participants from each sex group to each trait is plotted in Figure 5.5.

![Figure 5.5: The mean rating given by each sex of participant to each trait dimension for faces. Only competence was found to be evaluated significantly different male and female participants, with males giving higher ratings of competence to faces. SE bars of the mean are shown here.](image)

**Voices:**
5.0 An investigation on the role of ageing in trait evaluations

The mean rating for each trait dimension was calculated across each age group of stimulus for voices, and is shown in Figure 5.6. Firstly to establish whether or not there were differences in how each age group of the voices was rated on each dimension, separate repeated measures ANOVAs were carried out on each dimension, with category age of voice as the only factor. A main effect of voice age for attractiveness was observed for the attractiveness dimension \( [F(1,9) = 4.625, p = .02, \eta^2_p = .34] \). A Tukey post hoc test revealed that older adult voices were rated as significantly less attractive than younger or middle aged voices \((p < .01)\), and there was no difference between the ratings given to younger and middle aged voices. No main effect of vocal age was observed on any of the remaining trait dimensions (competence, \([F(1,9) = .57, \text{n.s.}]\), dominance, \([F(1,9) = .54, \text{n.s.}]\), distinctiveness \([F(1,9) = 2.18, p = .14]\), familiarity \([F(1,9) = .53, \text{n.s.}]\), trustworthiness \([F(1,9) = .55, \text{n.s.}]\).

![Figure 5.6: Mean rating for each cognitive dimension across all participants, according to the age of the voice stimulus. SE bars of the mean are shown.](image-url)
The age of the voice was then correlated with the ratings on each individual dimension. There were no significant correlations between the age of the stimulus and any of the trait dimensions, [attractiveness \( r(-.22) \), competence \( r(-.02) \), distinctiveness \( r(.22) \), dominance \( r(.01) \), familiarity \( r(-.12) \), trustworthiness \( r(-.19) \)].

The ratings for each dimension are plotted against the age of the voice stimulus in Figure 5.7.

![Figure 5.7: Correlation best fit lines for each trait across the age of the voice stimulus. No significant correlations between the age of the voice stimuli and any of the traits was observed. Individual scatter plot points have been removed for clarity.](image)

To establish whether or not there was a correlation between any of the dimensions a series of Spearman’s correlations were calculated for each possible dimension pair. The results of these analyses are presented in Table 9 and the correlations are shown in Figure 5.8. Significant positive correlations were found between the following dimensions; attractiveness & familiarity \( r(.37) \), attractiveness & trustworthiness
5.0 An investigation on the role of ageing in trait evaluations

$r(42)$ competence & distinctiveness $r(59)$, competence & dominance $r(65)$, competence & familiarity $r(62)$, competence & trustworthiness $r(30)$, distinctiveness & familiarity $r(50)$, dominance and familiarity $r(39)$, familiarity & trustworthiness $r(42)$. No negative correlations were observed. There was no evidence of correlations between the remaining possible trait pairs.

**Table 9:** Matrix of Spearman's correlations between dimensions rated. Values marked in bold indicate where one trait is significantly correlated with another, $p<.05$.

<table>
<thead>
<tr>
<th></th>
<th>Att</th>
<th>Comp</th>
<th>Dist</th>
<th>Dom</th>
<th>Fam</th>
<th>Trust</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attractiveness</td>
<td>1</td>
<td>0.24</td>
<td>0.20</td>
<td>0.09</td>
<td>0.37</td>
<td>0.42</td>
</tr>
<tr>
<td>Competence</td>
<td>0.24</td>
<td>1</td>
<td>0.59</td>
<td>0.65</td>
<td>0.62</td>
<td>0.30</td>
</tr>
<tr>
<td>Distinctiveness</td>
<td>0.20</td>
<td>0.59</td>
<td>1</td>
<td>0.75</td>
<td>0.50</td>
<td>0.15</td>
</tr>
<tr>
<td>Dominance</td>
<td>0.09</td>
<td>0.65</td>
<td>0.75</td>
<td>1</td>
<td>0.39</td>
<td>0.20</td>
</tr>
<tr>
<td>Familiarity</td>
<td>0.37</td>
<td>0.62</td>
<td>0.50</td>
<td>0.39</td>
<td>1</td>
<td>0.42</td>
</tr>
<tr>
<td>Trustworthy</td>
<td>0.42</td>
<td>0.30</td>
<td>0.15</td>
<td>0.20</td>
<td>0.42</td>
<td>1</td>
</tr>
</tbody>
</table>

**Supplementary Analyses:**

All possible trait dimension pairs were analysed for correlations by the age of the voice stimulus. Several significant correlations were observed for the different age group of voice stimuli which are outlined in the tables below. Correlations across all age groups of voices were less numerous than were observed in the visual condition. This may suggest that participants were less able to discriminate between vocal features that indicate certain traits making it more difficult to relate one trait to another. It may also suggest that voices are less commonly used to determine these traits. However, similar to the visual condition some correlations appear only in certain age groups or change as a function of the age group. For example, the older the voice is, the more likely it is to be positively correlated with trustworthiness. The...
5.0 An investigation on the role of ageing in trait evaluations

Figure 5.8: Scattergrams of correlations observed between trait pairs in the auditory condition. Each trait and its corresponding correlated trait are outlined on the X and Y axes of each plot with the rating scale of 1 – 7 for each trait at the origin point. Trend lines are marked in red.
strength of the correlations between attractiveness and trustworthiness however steadily increased with age in the visual condition again suggesting that relating these traits may be more easily done in the visual rather than auditory conditions. All trait correlations across each age group are summarized in Tables 10 to 12.

Table 10: Matrix of correlations between pairs of traits across Young Aged voice stimuli. Values marked in bold indicate a significant correlation (p<.05).

<table>
<thead>
<tr>
<th></th>
<th>Att</th>
<th>Comp</th>
<th>Dist</th>
<th>Dom</th>
<th>Fam</th>
<th>Trust</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attractiveness</td>
<td>1</td>
<td>0.01</td>
<td>0.14</td>
<td>0.17</td>
<td>-0.06</td>
<td>0.34</td>
</tr>
<tr>
<td>Competence</td>
<td>0.01</td>
<td>1</td>
<td>0.52</td>
<td>0.69</td>
<td>0.51</td>
<td>0.34</td>
</tr>
<tr>
<td>Distinctiveness</td>
<td>0.14</td>
<td>0.52</td>
<td>1</td>
<td>0.81</td>
<td>0.51</td>
<td>0.25</td>
</tr>
<tr>
<td>Dominance</td>
<td>0.17</td>
<td>0.69</td>
<td>0.81</td>
<td>1</td>
<td>0.35</td>
<td>0.36</td>
</tr>
<tr>
<td>Familiarity</td>
<td>-0.06</td>
<td>0.51</td>
<td>0.51</td>
<td>0.35</td>
<td>1</td>
<td>0.28</td>
</tr>
<tr>
<td>Trustworthy</td>
<td>0.34</td>
<td>0.34</td>
<td>0.25</td>
<td>0.36</td>
<td>0.28</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 11: Matrix of correlations between pairs of traits across Middle Aged voice stimuli. Values marked in bold indicate a significant correlation p<.05.

<table>
<thead>
<tr>
<th></th>
<th>Att</th>
<th>Comp</th>
<th>Dist</th>
<th>Dom</th>
<th>Fam</th>
<th>Trust</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attractiveness</td>
<td>1</td>
<td>0.43</td>
<td>0.63</td>
<td>0.39</td>
<td>0.77</td>
<td>0.40</td>
</tr>
<tr>
<td>Competence</td>
<td>0.43</td>
<td>1</td>
<td>0.72</td>
<td>0.74</td>
<td>0.66</td>
<td>0.31</td>
</tr>
<tr>
<td>Distinctiveness</td>
<td>0.63</td>
<td>0.72</td>
<td>1</td>
<td>0.83</td>
<td>0.65</td>
<td>0.46</td>
</tr>
<tr>
<td>Dominance</td>
<td>0.39</td>
<td>0.74</td>
<td>0.83</td>
<td>1</td>
<td>0.46</td>
<td>0.31</td>
</tr>
<tr>
<td>Familiarity</td>
<td>0.77</td>
<td>0.66</td>
<td>0.65</td>
<td>0.46</td>
<td>1</td>
<td>0.45</td>
</tr>
<tr>
<td>Trustworthy</td>
<td>0.40</td>
<td>0.31</td>
<td>0.46</td>
<td>0.31</td>
<td>0.45</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 12: Matrix of correlations between pairs of traits across Older Aged voice stimuli. Values marked in bold indicate a significant correlation p<.05.

<table>
<thead>
<tr>
<th></th>
<th>Att</th>
<th>Comp</th>
<th>Dist</th>
<th>Dom</th>
<th>Fam</th>
<th>Trust</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attractiveness</td>
<td>1</td>
<td>0.27</td>
<td>0.06</td>
<td>-0.27</td>
<td>0.34</td>
<td>0.56</td>
</tr>
<tr>
<td>Competence</td>
<td>0.27</td>
<td>1</td>
<td>0.59</td>
<td>0.59</td>
<td>0.63</td>
<td>0.11</td>
</tr>
</tbody>
</table>
Finally each trait dimension was examined using a between groups Mann Whitney U test to determine if male and female participants evaluated traits differently from each other. A significant difference was observed for familiarity (Mann-Whitney U=2.5, p=.04, sig<.05), with male participants giving higher ratings than females. No other significant differences were observed: attractiveness (U=7.0, p=.28), competence (U=6.0, p=.20), distinctiveness (U=10, p=.60), dominance (U=7.0, p=.79), trustworthiness (U=10, p=.61). The mean rating given by male or female participants to each trait is plotted in Figure 5.9. Similarly to the face condition these results indicate that males and females evaluated voices in the same way when making trait judgements, however no pattern for males giving higher ratings to certain dimensions of voices, as seen in the face condition, was observed here. The difference in evaluation of familiarity may suggest the males rely more on vocal cues when seeking to identify whether a voice is familiar or not. Van Lanker, Kreiman & Emmory (1985) found a tendency for male participants to more readily identify voices than female participants, whereas Rehnman & Herlitz (2006) pointed out that females tend to outperform males on face recognition, suggesting that gender may play a role in how a specific stimulus is used to evaluate a trait.
5.0 An investigation on the role of ageing in trait evaluations

5.4 Discussion

It is uncertain whether or not the factors driving the perception of a trait like attractiveness in early adulthood are the same in older adulthood. Attractiveness preferences, for example, have been explained in the context of maximising reproduction or nurturing. However, it is unlikely that older adults maintain the same drive to seek out partners who possess features that are most conducive to reproducing. Unsurprisingly the vast majority of studies examining this have taken their results from participants who are of average reproductive age, typically those from participants in their twenties to forties. In the case where reproductive maximization is concerned it is logical that perceived attractiveness is influenced by features indicating health and good genes (e.g. symmetry, averageness, even skin texture). Where biological imperatives are removed or lessened, so too may the...
5.0 An investigation on the role of ageing in trait evaluations

importance of symmetry or averageness for the older adult perceiver. Consequently this may also result in differences in how the ratings of a trait such as attractiveness correlates with those of another trait. The results from Chapter 4 illustrated that older adults gave significantly higher ratings across all age groups of stimuli, including their own, suggesting that attractiveness or appeal does indeed change with age and experience.

The aim of the present study was to examine how older adults would evaluate faces and voices on different trait dimensions including attractiveness, dominance, distinctiveness, familiarity and trustworthiness. To date much of what we understand about trait inferences from faces and voices stems from studies using only young adult participants, or using predominantly young adult stimuli. Little is known about whether these trait evaluations remain stable during ageing of the participant or the stimulus. This study allowed for the examination of any changes that may occur as a result of ageing by testing an older adult population on a range of stimuli of different ages.

In the visual condition it was observed that ratings for a number of traits declined as the age of the face increased. Negative correlations were observed between the age of the face and attractiveness, face age and competence, face age and familiarity and face age and trustworthiness. The results of Chapter 4 indicated that as the face aged the ratings of attractiveness for the face decreased. Interestingly, while this result is also evident here, the negative correlation between face age and attractiveness was the strongest of any of the observed correlations. The reliability of attractiveness
judgements was also high suggesting that it may be the most readily evaluated trait among those measured, at least for faces, however, it could also be argued that attractiveness is more of a direct property of the physical structure of the face whereas other traits will require more inference. The analysis of individual traits across the three age groups of the face stimuli showed the same trend for a reduction in the perceived attractiveness, competence, familiarity and trustworthiness with age, but these were most significant for attractiveness and competence where older adult faces received the lowest ratings of the three age groups.

Correlations between trait pairs were also observed, most of which were positive in directions, especially the correlations between the ratings of attractiveness and other traits such as competence, dominance, familiarity and trustworthiness: where ratings of attractiveness where high so too were the ratings on each of these dimensions. Attractiveness was negatively correlated with distinctiveness, and this result replicates the result of other studies using younger adults (such as Peskin & Newell, 2002).

The results from the auditory condition differed somewhat from those of the visual condition. No correlations with the age of the voice, either positive or negative, were observed for any of the traits measured, and this is in contrast to a number of negative correlations observed in the visual condition where the age of the face led to a decrease in ratings. This result may suggest that the participants here relied more heavily on visual information for evaluating these traits. However, although not significant, an inspection of the trend lines in Figure 18 showed that there appeared
to be some negative correlations between the age of the voice and certain traits. The results in the voice condition also showed that the decline in ratings of attractiveness with the age of the voice was one of the strongest, as was observed in the face condition. An analysis of the individual traits for each age group of voice stimuli showed that attractiveness ratings of older voices was lower than for the young or middle aged groups of voices. Similar to the face condition the results from the voice condition indicate that participants most readily evaluated attractiveness among the traits measured.

For the voice stimuli, a number of correlations between the trait pairs were also found, however, the same correlations did not emerge for voices that were seen with faces. Where attractiveness had some correlation with most of the other traits measured in the visual condition, no correlations were observed between attractiveness and competence, distinctiveness or dominance of voice stimuli. The lower overall number of correlations suggests that participants may not have been as good at extracting information relevant for trait judgements from voices thereby making it more difficult to relate one to another.

The results of the present study show that older adults made similar trait judgements under similar conditions to younger adults, as has been established in other studies. However some differences were noteworthy. Inter-rater reliability appears to be lower overall than has been observed in other studies measuring similar traits. While the results here showed that the older adult participants in this study readily made judgments of attractiveness to face stimuli, and that agreement was relatively high
5.0 An investigation on the role of ageing in trait evaluations

(.84) this level is agreement is still somewhat lower than has been observed with younger adults. Willis & Todorov (2006) showed that in a sample of around 250 undergraduate students agreement on ratings of attractiveness was much higher at around .96, furthermore their agreement on other traits, which were also measured in the current study, were also higher, for example competence (.83) and trustworthiness (.90). Inter-rater reliability was particularly low for dominance in the evaluation of faces in this study (.39).

Dominance judgements can be driven by cues such as the sex of the face (Schwartz, Tesser & Powell, 1982) gaze direction, (Benedict et al, 2009), hairlines and age (Guthrie, 1970; Keating, 1985; Wogalter & Hosie, 1991). These findings suggest that certain features of ageing, such as receding hairlines or lip thinness, may contribute directly to judgements of dominance or other traits. Muscarella & Cunningham (1996) demonstrated that increasing baldness increased the perceived age and maturity of a face but decreased perceptions of attractiveness and aggressiveness. However these studies tended to comprise mostly of images of younger adults where these features were manipulated to make them look older. An inspection of the older and middle-aged male face stimuli used here show a large variation in the relative amount of cranial hair compared to younger stimuli. Should this have been a factor in participants’ judgements of dominance in faces, it may explain the low level of overall agreement, as face stimuli displayed a wide range of cranial hair which may have attracted a wider range of responses.
5.0 An investigation on the role of ageing in trait evaluations

The low level of agreement across ratings of dominance on faces contrasts sharply with the relatively high level of agreement for voices (.76), and may suggest that older adults use faces and voices to extract different inferences as suggested by Rosenthal et al. (1977). Whereas a larger number of visual features can potentially contribute to evaluations of dominance in faces, voice pitch and frequency are known to be the main drivers of dominance perception in voices and so may be less ambiguously perceived (Borkowska & Pawlowski 2011). Further evidence to support stimulus specific inferences may be seen in the evaluation of distinctiveness. Perceived facial distinctiveness has been shown to be negatively correlated with ratings of visual attractiveness (Peskin & Newell, 2002) and this result is replicated here, albeit with a low correlation strength. However, no such correlation in the results was found with voice stimuli. As with dominance, the relative differences in the number of vocal features to evaluate is less than might be available for faces making the distinction between voices more difficult. The evidence here would suggest that a specific stimulus, such as a face or voice, may be relatively more informative than the other at providing sufficient information in order to make a reliable inference of a specific trait.

While high levels of agreement in studies using younger adults make it easier to draw conclusions about how a trait is perceived or how it relates to another for that age group, such large discrepancies in agreement in older adults make this more difficult. There may be several reasons for low levels of agreement in the present study.
As outlined in Chapter 4, one of the key differences between younger and older adults is experience. Whereas younger adults in that study rated faces of all age groups as less attractive, older adults gave higher ratings to faces in all age groups which may have been due to their experience of their own ageing face as well as a vested interest in other age groups such as their children or grandchildren. As well as additional experience, the variation in experience will also likely be much greater for older adults. The most typical population used in trait perception studies are undergraduate college students (Kniffin & Wilson, 2004; Little & Hancock, 2002; Mattes et al., 2010; Willis & Todorov, 2006). For a study using undergraduate participants, their level of experience in trait evaluation will not only be several decades shorter than the older participants used here, but their type of experience is possibly much more homogenous, likely having spent the past decade or so moving from one educational environment to another. Older adults on the other hand will have accrued many more individual and diverse experiences through different lines of work or having a family etc. The relative lack of experience as well as the homogeneity of those experiences in younger adults could likely contribute to high levels of agreement in other studies, having all experienced or evaluated these traits in a similar manner. Age and experience may lead to different evaluations of different traits, for example evaluation of attractiveness may be different for an older adult where reproductive priorities may not be as high and as such are more able to find attractiveness in older faces. Perception of other traits such as dominance, competence or trustworthiness may also change as a result of experiences in working or family life, which are likely to further differ from participant to participant in older
adults. The low levels of agreement may indicate that experience and individual
differences play a larger role in how older adults evaluate traits.

While the current study found that some of the correlations of ratings to faces that
have been shown to exist for younger adults, as discussed later, were present in the
older adult participants here, these correlations were sometimes low to moderate.
Where typically some correlations between attractiveness and some of the traits
measured here, such as dominance or trustworthiness, have shown to be high in
previous studies using younger participants and faces (Fink et al., 2007; Ohanian,
1990) the same correlations were relatively low here.

Beginning with Dion, Berscheid & Walster (1972), a large body of research concerning
attractiveness has repeatedly shown a halo effect for attractive faces with positive
characteristics being ascribed to attractive individuals. Attractiveness has previously
been positively correlated with competence (Jackson, Hunter & Hodge, 1995) and
familiarity, (Peskin & Newell, 2002). Although these positive correlations were largely
persevered in the results of the older adults in this study, these were to a weaker
extent in some cases. The halo effect has come to be a generally accepted
phenomenon, but the consistency of the effect may not be as strong as widely
believed and as evidenced in the results found here. In their meta-analyses of the
halo effect, Eagly et al. (1991) and Feingold (1992) showed that although there was a
tendency to ascribe positive characteristics to attractive individuals, these were not
always consistent across studies and in some cases produced only moderate
correlations at best.
Some studies have argued that with ageing comes wisdom and a lower likelihood of basing decisions on attractiveness (Baltes & Smith, 2008). The low correlation between attractiveness and trustworthiness from faces observed here may reflect an overall weakening of the halo effect as we age. Zebrowitz & Franklin (2014) found that although there was a halo effect for younger and older adult participants for attractiveness and trustworthiness, the effect was weaker for older adults. While there may appear to be a halo effect for attractiveness and some other traits here, these correlations were moderate at best. This contrasts with the strong correlations observed in studies with younger adults (Lewis & Bierly 1990). The trend for lower positive correlations with attractiveness lends support to the idea of a weakening of the halo effect in older adults' evaluation of faces or that attractiveness may even take on a different meaning. The difference in the strengths of the correlations observed here and those found in previous studies may also be a reflection of the type of stimuli used. Where Zebrowitz & Franklin included grayscale as well as coloured images of faces, the use of more consistent stimuli here may reflect a more naturalistic evaluation of faces. Colour in faces has been shown to be an important feature when making judgements of attractiveness. Perrett (2012) showed that differences in natural skin colour, for example those with higher versus lower levels of melanin in skin, were associated with different attractiveness ratings and perception of overall health.

While it appears that age-related changes, both those observed in other faces and voices as well as the changes which occur to the perceiver, may influence what is considered attractive, it is reasonable to propose that such changes may also
influence how other traits are evaluated. For example, a trait such as dominance, which has been shown to be correlated with perceived attractiveness to the female perceiver when rating male faces (Perrett 2008), is known to be related to masculinity. However, features which are associated with masculinity are not stable throughout the lifespan. As testosterone production changes from childhood through to early adulthood it increases masculine features which are associated with dominance (Neave et al., 2003; Swaddle & Reierson, 2002). As levels of this hormone begins to decrease in later adulthood so too could perceived masculinity and indicators of dominance. A number of studies have indicated that although dominance perception is related to age this relationship is curvilinear with individuals at each end being rated lower in dominance, (Berghe & Barash, 1977; Guthrie, 1970;).

Where an older female perceiver is concerned, preference changes with regard to perceived attractiveness of male faces are also likely to result in changes in evaluations of the role of dominance. If dominance had been an indicator of masculinity or good genes and played a larger role in a younger female’s evaluation of attractiveness, this trait may no longer possess the same relative influence on the older female perceiver. In addition to ageing, the results of the present study also showed that the sex of the perceiver may influence how a trait is evaluated, with differences in how competence and familiarity were evaluated.

The results from both the faces and voices conditions illustrate that the same correlations do not necessarily occur in each age group of stimulus. Such age specific results however should not necessarily be unexpected. For example in the case of
facial distinctiveness where ageing causes some features to change over time, such as looser skin elasticity or skin texture uniformity, such deviations are likely to lead to an increased number of age-specific features which consequently render them more distinctive. As discussed previously, distinctiveness has been typically negatively correlated with attractiveness. In the present study, negative correlations between attractiveness and distinctiveness were observed for middle aged and older aged face stimuli but not for young stimuli. This may be as a result of the higher instances of asymmetries or differences in skin texture being more likely to be present in middle aged and older adult faces. It is therefore not unreasonable to infer that that age of the face or voice stimulus may influence how other specific traits may be evaluated.

In addition to trying to understand how older adults form trait impressions from unfamiliar faces and voice, and how these traits might be inter-related, this study also sought to see how these evaluations would be made on faces and voices across a broad range of different ages. The few other studies that have examined age-specific trait evaluations have mostly comprised of evaluations of younger and older adult stimuli (Zebrowitz et al., 2013). The main finding in the face condition was that as the age of the face increases ratings on several traits tended to decrease. Attractiveness, competence, familiarity and trustworthiness were all negatively correlated with face age in spite of the fact the participants themselves were older adults, suggesting that there was no own-group bias. This trend was not evident in the auditory condition where no significant correlations between increasing age of the voice and traits were observed, although an inspection of the trend line did appear to indicate that ratings on some traits may have decreased as a function of age. Contrasting this with the
results in face conditions likely suggests that older adults may rely more on vision when evaluating traits. However it cannot be discounted that the order chosen for the experiment, with the longer face evaluation part being done first, may have led to some fatigue or reductions in attention in the latter voice rating parts.

Studies have shown negative stereotypes associated with ageing and these attitudes are particularly prevalent in younger adults (Chasteen, Schwarz & Park, 2002; Coudin & Alexopoulos, 2010; Goldman & Goldman, 1981). Surprisingly however the results from the older adult participants here in the face condition also showed that increasing age of the face was associated with decreasing ratings for a number of important social dimensions such as attractiveness, competence, familiarity and trustworthiness. Some studies have indicated that internalised negative stereotypes about ageing at a young age may be difficult to modify as the person ages (Levy, 2003). Furthermore Bennett & Gaines (2010) suggested that older adults themselves are influenced by these negative stereotypes and unknowingly incorporate these into their perceptions of themselves and others. The findings here showing decreases in the evaluations of certain traits as a function of face age may reflect some degree of internalised negative stereotyping.

A number of methodological issues exist in the current study that may have had some bearing on the results found here. One such methodological difference between this and other studies which may have affected the results is the duration of exposure to the stimuli. Many studies have allowed their participants longer or unrestricted viewing times for making trait judgements (Castle et al., 2012; Hess & Kotter-Gruhn,
An investigation on the role of ageing in trait evaluations

2011; Rhodes et al., 2011). Willis & Todorov (2006) demonstrated that undergraduate participants could make reliable trait inferences based on as little as a 100msec exposure to the face and that inter-rater reliability under these conditions was high. In the present study I elected to use a longer, but restricted exposure time of 1 sec for the face stimuli. The results demonstrate that older adults are able to make trait judgements, such as attractiveness, competence, distinctiveness, familiarity and trustworthiness under these conditions, however the reliability levels of these judgements were found to differ greatly. A number of studies have indicated that older adults make fewer saccades when inspecting a scene (Munoz et al., 1998; Porter et al., 2010). The restricted viewing time used in the current study may have made older adults less able to evaluate all the features they may have considered important for making a judgement of that trait. If there are also additional individual differences in older adults as discussed above, this may have contributed to the high variability observed on the inter-rater reliability results.

One of the biggest difficulties facing this and many other studies concerning face and voice trait inference and their relationship to one another is the fact that they are usually comprised of visual and auditory stimuli that are unrelated (i.e. evaluated faces and voices are not from the exact same individuals). Although the current study endeavoured to use unedited natural stimuli and a broad range of ages to gain a better understanding of how traits may be perceived in a more natural context, it is not possible to conclude how evaluations of traits of a face would transfer to the voice belonging to that face. Future studies could expand on the results found here by endeavouring to use face and voice stimuli from the same identities. Furthermore
another issue to consider in future studies is the nature of how the face and voice stimuli themselves are presented. In the face condition here the image was presented as a static image in a neutral expression, but the presentation of voice information could not necessarily be considered analogous. Where a still snapshot of a face can be sufficient to be able to recognise or identify features and expressions of a person it is not possible to present a voice in exactly the same manner. By its nature a voice clip is more dynamic and temporally distributed than is an image snapshot. The voice is therefore presented in a way it is more naturally perceived in the real world. It may be useful to consider some dynamic face stimuli for these tasks by, for example, presenting the person as they are speaking.

5.5 Conclusion

This study sought to examine whether ageing of the participant or the age of the face or voice were factors which influenced how traits are perceived and correlated. In the current study, older adult participants rated unfamiliar face and voice stimuli across a number of trait dimensions under constrained stimulus durations. The results here indicated that older adults make similar trait judgments as previously reported in studies involving younger adults but that the strength of those correlations and agreement on how they are rated appears to be different from other studies using young adult participants. Furthermore some correlations appear to be unique to the age of the stimulus, such as attractiveness and distinctiveness.

By using older adult participants the current study allowed for the contrast with the findings that have been made with younger adult groups. The results here show that
trait perception is not stable and that ageing of the participant and the stimulus is a factor in this change. The results and discussion here have identified that there may also be a number of factors or influences present in the evaluations made by older adults on traits that are likely not present in younger adults such as the role and diversity of experience. Further study is needed to conclude how and when these changes may occur by using a more comprehensive age set of participants. While facial information does appear to dominate in trait perception by older adults, the relatively small number of vocal stimuli used may have contributed to the lack of any significant correlations, making it difficult to determine how the voice is used in trait perception. Finally the somewhat surprising results that older adults gave lower ratings on certain traits as a function of the age of the stimulus warrants further investigation of how self-perception, particularly in terms of ageing stereotypes, may affect how older adults evaluate these traits.
6.0 An investigation of visual scan participants for older and younger adults when evaluating attractiveness

Abstract

Judgements of attractiveness can be made across all sensory modalities, however it appears that when making judgements of attractiveness vision tends to dominate. In particular, faces provide an abundant amount of information about the individual such as age, sex, health, mood etc. from which to draw on these judgments. Much of this understanding has focused on the differences between male and female preferences of attractiveness and is drawn primarily from younger adults. Here I sought to determine if older and younger adults evaluated faces in the same way and in particular if they differed in their examination of salient features such as eyes and mouth through the use of eye-tracking measures. No significant differences emerged between older and younger adults when evaluating faces as measured by fixations and duration of fixations in areas such as the eyes and mouth. However inspection of scan patterns through heat maps reveal that there may be some subtle variations in exactly how each group attends to areas such as the eyes.

6.1 Introduction

The nature of attractiveness has captivated both science and popular culture alike. As such a mixture of myth and fact has crept into what are believed to be the general rules and features that underlie attraction and attractiveness. Beauty is said to be in the eye of the beholder, yet countless studies across several decades and cultures have revealed that there are in fact a number of features that are universally
6.0 An investigation of visual scan participants for older and younger adults when evaluating attractiveness such as averageness and symmetry (Apicella, Little & Marlow, 2007; Rhodes 2006; Valentine, Darling & Donnelly, 2004;).

Many of our attractiveness preferences are thought to have evolved from physiological indicators of good health and genes which maximize the possibility of reproducing (Buss, 2004; Fletcher et al., 1999). More recently many studies have emerged indicating that attractiveness evaluations go beyond simply averageness or symmetry and extend to complex social decisions made about diverse stimuli such as faces, voices, gait etc (Lewis & Bierly 1990; Willis & Todorov 2006; Zebrowitz & Montpare 2008).

The most common thread underlying all of these studies however is the differences in evaluations caused by the relatively large sexually dimorphic differences between male and female faces. Features attractive in one sex do not necessarily appear attractive in the other. For example a low waist-to-hip ratio (WHR) in females is attractive to males because low WHRs are associated with the type of fat and muscle distribution related to female sex hormones, which can be a reliable indicator of reproductive health (Singh 1993; Singh 2002). Such a distribution in males would be less attractive because it would indicate a low level of testosterone.

Understandably, individual differences between male and female perceptions and evaluations of attractiveness have received the overwhelming amount of attention in this area of research. Yet the bulk of this knowledge is focused on a relatively narrow age range, specifically the age range where reproduction is most likely to occur, typically from men and women aged in their twenties to forties. While this age range
An investigation of visual scan participants for older and younger adults when evaluating attractiveness is not insubstantial. Few studies have directly addressed how attractiveness perception changes across this period of time, instead tending to simply focus on the coarse individual differences between males and females as a whole. Fewer studies still have sought to examine how attractiveness is evaluated from faces above this age bracket.

Both the quantitative and qualitative measures commonly used in studies on attractiveness tend to rely on scales or questionnaires. While these are sensitive enough to accurately gauge preferences in attractiveness across different sensory modalities, or across individuals, they do not necessarily provide a fine enough measure of what information exactly is being extracted from the stimulus. For example, measuring the attractiveness of different voices using an attractiveness scale is sufficient to tell us how voices differ in their attractiveness but are not sufficient at revealing whether the perceiver is using pitch, frequency, timbre or cadence when making that decision.

Biologically speaking the older we get the less likely we are to be concerned with maximising reproduction, consequently this has potential to change what exactly we deem or value to be attractive or unattractive. A number of results from the Chapters 4 and 5 in this thesis have indicated that older adults' evaluation of visual and vocal attractiveness and trait perception differs from that of their middle aged or younger counterparts. However it is clear that like younger and middle aged adult groups, older adults' judgements are primarily driven by facial stimuli when making judgements of attractiveness. While the measures used in these studies were
sufficient to indicate that such differences existed across both the age of the participant and the age of the stimulus (face or voice), they were not sensitive enough to determine the exact nature of the information being extracted from the faces.

Visual dominance in attractiveness judgements is not surprising given the amount of information communicated by the face both in terms of its physical structure and properties, such as symmetry or skin texture, but also its ability to relay changing dynamic information such as expression or speech through the mouth and similarly expression and gaze direction through the eyes. In fact faces are said to attract our gaze more than almost any other item in our environment (Bruce & Young, 2012; Hershler & Hochstein, 2005). Treisman & Gelade (1980) demonstrated that faces appeared to 'pop out' and were detected more quickly than other objects in scenes where there were a large number of other items and did not necessarily require the participant to sequentially search through the scene. Furthermore, even within a scene containing a large number of neutrally expressive faces a single angry face has been shown to also 'pop out' and be quickly and easily detected (Fox et al., 2000).

Within the face itself, the eyes and mouth in particular provide a wide array of information useful in evaluation of attractiveness. The sclera, or whites of the eyes, are unique to humans, and are thought to have evolved to help in hunting cooperation and other affiliative acts (Perrett, 2010). The changing position of the eye and the contrast between the large sclera and the darker colour of the iris allow us to accurately infer where a person's gaze is directed, even over large distances (Watt, Craven & Quinn, 2007). Gaze is often used to detect reciprocal interest, where direct
6.0 An investigation of visual scan participants for older and younger adults when evaluating attractiveness

eye contact can perceived as an indication of warmth or receptivity (Kleinke, 1986). Similarly the mouth can be used to make physical and social judgements relative to attractiveness.

One of the most obvious sources of social information determined by the mouth are expressions such as smiling which are readily communicated and perceived as being friendly and showing reciprocal interest. Even the shape of the mouth itself in a resting neutral state has been implicated in both positive and negative trait judgements (Dzhelyova, Perrett & Jentzsch, 2012; Oosterhof & Torov, 2008). Burt & Perrett (1995) also suggested that the mouth provides a useful reference frame for judging the overall symmetry of the face by using distances from the edge of the mouth to the edge of the face etc.

Determining where individuals look when attending to a face has provided another level of understanding in how attractiveness is evaluated. Eye tracking studies have revealed that eyes are often the first feature attended to when looking at a novel face (Hassebrauck, 1998; Janik et al, 1978). This is typically followed by an examination of the mouth area leading to an overall T-shape scan pattern when attending to new faces (Henderson, Williams & Falk, 2005; Williams & Henderson, 2007). Individual differences have also been observed in eye tracking studies of bodies and faces with men and women differing in areas of first inspection or percentage of time spent attending to different features (Rupp & Wallen, 2007). In their eye-tracking study, Munoz et al. (1998) demonstrated that older adults have longer saccades than younger adults, and consequently fewer fixations when viewing a scene. Porter et al.
An investigation of visual scan participants for older and younger adults when evaluating attractiveness (2010) also showed that older adults also required more saccades to reach a target in a complex visual scene.

Prominent changes occur to both the eyes and mouth as a result of ageing. Hormonal variances change fat distribution and elasticity in the skin causing eye lids to droop making the eyes appear smaller and narrower in older adults by reducing the amount of the visible sclera. Wide large eyes are a feature of younger faces and femininity, the reduction in the apparent size of the eyes consequently leads to an increased perception of age and a reduction in attractive properties like femininity in females. These hormonal changes also lead to changes in mouth shape as well as a reduced blood supply to the lips making them appear thinner and less full than they would normally be when younger. While eye movement studies have highlighted the extent to which the eyes and mouth are used in face and attractiveness evaluations and that individual differences do occur, scant attention has been focused on these regions in terms of how ageing affects their evaluation of attractiveness but also in how the age of the individual affects how they are evaluated.

Based on this knowledge the aim of the present study was to investigate the type of features younger and older adults attend to when looking at a face in order to make a judgment of attractiveness by using eye-tracking measures. Specifically I was interested in determining how the eyes and mouth areas would be scanned by younger and older adults by measuring the number of visual fixations in these areas and the amount of time spent looking at those areas.
6.0 An investigation of visual scan participants for older and younger adults when evaluating attractiveness

6.2 Method

Participants

Twenty two participants (11 female, 11 male) with a mean age of 47.8 years (SD = 23) volunteered to take part in the study. Their ages ranged from 21 to 75 years. All participants reported normal or corrected to normal vision. Participants were divided into two groups for the purposes of later analysis, 11 younger adults (21-32yrs) and 11 older adults (58+yrs). The younger adult age group, drawn from the student population of Trinity College Dublin, consisted of 6 males and 5 females with a mean age of 25.8 (SD = 3.9), their ages ranged from 21 to 32 years. The older adult age group consisted of 5 males and 6 females with a mean age of 69.9 (SD =5.3), their ages ranged from 58 to 75 years. Participants were instructed on the task and provided written consent before taking part in the study.

Apparatus & Stimuli

Eye-tracking

Eye movements for the current study were recorded using the EyeLink® 1000 (SR Research Ltd, Ontario, Canada) desk mounted unit. Eye positions and movements were determined from measuring corneal reflection and pupil darkness with a video based infrared camera and infrared reflective mirror. The eye tracker had an average spatial resolution of 0.01° of visual angle and was sampled at a rate of 1KHz. Although viewing was binocular, recording was monocular and was conducted using the participants’ dominant eye. Eye dominance was determined by asking the participant
6.0 An investigation of visual scan participants for older and younger adults when evaluating attractiveness
to create a small triangle aperture using their hands. Through this aperture they were asked to focus on an object on the wall approximately 4.5m away with both eyes open. Participants were then instructed to close one eye at a time, the dominant eye was determined as the one in which the object did not appear to move outside of the aperture. Prior to recording, calibration and validation was conducted to establish accurate eye tracking.

Stimuli

The face stimuli comprised of photographic images of eight models taken from the FACES Max Planck Institute for Human Development database. Some of these face images were also used in Chapter 5 of this thesis. Four female and four male models were used and consisted of two older models and two younger models in each male and female group. Prior to this study the models used here had been rated as part of a larger group of stimuli by a separate group of younger raters in a different experiment (not reported in this thesis). The models selected for this experiment were those rated as the most and least attractive from that study. Consequently for the four younger models and four older models two were deemed to be attractive and two unattractive (1 attractive male, 1 attractive female, 1 unattractive male, 1 unattractive female). Photographs were edited to remove external features such as hair and clothing and placed centrally on a black background at a resolution of 1024 x 768 pixels. See figure 6.1 for an example of a stimulus used. The face images subtended an average angle of approximately 16.6° vertically and 10.3° horizontally at a distance of 58cm from the screen: this represented the approximate actual size
6.0 An investigation of visual scan participants for older and younger adults when evaluating attractiveness of viewing a face at that same distance and allowed sufficient size to specify separate non overlapping areas of interest (AOI).

Defining areas of interest:

Two areas of interest were specified for subsequent analysis of eye tracking data (1) Eye Area: This was defined as the area from just above the eye brows to the top of the cheek, (2) Mouth Area: This was defined as the area from just below the nose to just above the chin boss, see Figure 6.1 for an illustration (3), Other Areas: This was defined as the regions outside the Eye and Mouth AOIs. These areas were chosen for their visual salience and importance in evaluations of attractiveness as well as general social interactions (Hassebracuk, 1998; Henderson, Williams & Falk, 2005; Janik et al., 1978; Williams & Henderson, 2007). In each of the AOIs two dependent variables were measured, number of fixation per area and time spent (duration of fixations) examining the area.

Figure 6.1: Sample of defined AOIs. Eye AOI (1) and mouth AOI (2) regions were selected for visual saliency and role in age and attractiveness perception and are represented by the yellow rectangles. The 'Other Areas' AOI (3) is the remaining area outside of the yellow rectangles.
Design

The experiment was based on a three-factor, mixed design with age of participant (younger/older) as the between subjects factor and age of face stimulus (younger/older) and AOIs (eyes, mouth, other) as the within subjects factors. There were a total of 8 exposure trials where eye movements were recorded, the dependent variables recorded were number of fixations and the duration of those fixations. A separate rating block, where no eye movements were recorded, was used to rate the faces seen in the exposure block. Faces were presented for 8 seconds each after which participants were asked to rate the face for attractiveness using a scale ranging from 1 – 7 where 1 was ‘very unattractive’ and 7 was ‘very attractive’. Participants were encouraged to use as much of the scale as possible and to answer as quickly as possible.

Procedure

The experiment was programmed and presented using Presentation software and linked to the EyeLink PC which recorded eye movements. The experiment was presented on a colour LCD monitor (1024 x 768px) at a 60Hz refresh rate using the Presentation software running a 2.3GHz PC with 6GB RAM. Participants faced the monitor at a distance of 58cm from the screen. Head stability was maintained by using a forehead and chin rest. Participants were instructed that they would view a set of faces which they would later rate for attractiveness. Each image was presented individually for a duration of eight seconds. Image order was randomised across
6.0 An investigation of visual scan participants for older and younger adults when evaluating attractiveness

participants. During the presentation of each face stimulus eye movements were recorded. Following the exposure sequence participants viewed each face again and were asked to rate the face for how attractive they found it to be on scale from 1 to 7 where 1 was very unattractive and 7 was very attractive. The order in which the faces were rated was randomized and participants were encouraged to use as much of the scale as possible and to answer as quickly and accurately as possible. For the rating phase no eye movement data was recorded. Responses for the attractiveness rating were collected via a standard keyboard.

6.3 Results

Attractiveness Ratings

The mean attractiveness ratings were calculated for each age of face based on older and younger participant responses. The results were compared using a mixed ANOVA. A main effect of the age of the face was found \( F_{1,20} = 68.28, p < .00001, \eta^2_p = .77 \). An inspection of the means revealed that younger faces were rated as being more attractive than older faces, these are graphed in Figure 6.2. No significant interactions were observed between any of the factors.
6.0 An investigation of visual scan participants for older and younger adults when evaluating attractiveness

![Graph showing mean attractiveness rating for each age of stimulus by the age of the participant. Younger face stimuli were rated as being more attractive than older face stimuli. There was no significant difference in how the groups rated the faces. SE bars of the mean are shown.](image)

**Figure 6.2**: Mean attractiveness rating for each age of stimulus by the age of the participant. Younger face stimuli were rated as being more attractive than older face stimuli. There was no significant difference in how the groups rated the faces. SE bars of the mean are shown.

To examine if there was any significant difference between the faces that had previously been rated as high and low attractiveness, responses given for these faces were collapsed and compared. The results were compared using a mixed ANOVA. A main effect of the attractiveness of the face was found \([F(1,20) = 37.61, p<.00001, \eta^2_p= .65]\). An inspection of the means revealed that higher attractiveness faces were rated as being more attractive than lower attractiveness faces, this is in line with the previous rating of this faces, these are graphed in Figure 6.3. No significant interactions were observed between any of the factors.
An investigation of visual scan participants for older and younger adults when evaluating attractiveness

Figure 6.3: Mean attractiveness rating for high and low attractiveness faces by the age of the participant. As expected high attractiveness face stimuli were rated as being more attractive than low attractiveness stimuli. There was no significant difference in how the groups rated the faces. SE bars of the mean are shown

No. of Fixations by AOI

Mean number of fixations were computed for each AOI and the age of the face stimulus for each group of participants. A 2(Participant Group) x 2 (Age of the Stimulus) X 3 (AOI) mixed ANOVA revealed that there was no main effect of participant age \(F_{1,20} = .317, p<1\). There was also no main effect of the age of the face stimulus \(F_{1,20} = .207, p<1\). A main effect for AOI was observed \(F_{2,40} = 102.2, p<.0001, \eta^2_p = .83\]. Specifically, a Tukey post-hoc test revealed that participants fixated on the eyes more frequently than either of the other two AOI and that they fixated more frequently on the ‘Other’ AOI more frequently than on the Mouth AOI.
6.0 An investigation of visual scan participants for older and younger adults when evaluating attractiveness (p<.05). No interactions were observed between any of the factors. The mean number of fixations are plotted in Figure 6.4.

![Figure 6.4: Mean number of fixations for AOIs for the age of the face and age of participant. Eyes attracted more fixations than the Mouth or Other AOIs. Number of fixations also significantly differed between Mouth and Other AOI, with the Other AOI attracting more fixations than the Mouth AOI.](image)

**Duration of Fixation by AOI**

Mean duration of fixations were computed for each AOI and the age of the face stimulus for each group of participants. An ANOVA revealed that there was no main effect of participant age age [F(1,20) =.01, p<1]. There was also no main effect of the age of the face stimulus age [F(1,20) =.02, p<1]. A main effect for AOI was observed [F(2,40) =85.94, p<.0001, η^2_p=.81]. Specifically, a Tukey post-hoc test revealed that participants spent longer durations fixating on the eyes than on either of the other two AOIs, however there was no significant difference in duration of fixation between the Mouth and Other AOIs, (p>.05). No interactions were observed for any of the factors. Means are plotted in Figure 6.5
6.0 An investigation of visual scan participants for older and younger adults when evaluating attractiveness

![Figure 6.5](image.png)

**Figure 6.5**: Mean duration of fixations for AOIs for the age of the face and age of participant. Eyes attracted more fixation duration than the Mouth or Other AOIs. Duration of fixations did not significantly differ between Mouth and Other AOI.

*Relative Attractiveness & Total Fixations*

To examine if the relative attractiveness of the face had any effect on participants viewing patterns the mean total number of fixations for high attractiveness faces and low attractiveness faces was compared across participant groups. No significant difference between groups for the relative attractiveness of faces was observed on the total number of fixations. The mean number of fixations are plotted in Figure 6.6.
6.0 An investigation of visual scan participants for older and younger adults when evaluating attractiveness

![Image]

**Figure 6.6:** Mean number of fixations for high and low attractive faces by the age of the participant. There was no significant difference between the attractiveness of the face and the mean number of fixations made by the participant.

*Other Areas of Interest*

Finally to examine where older and younger adults tended to look outside the eye and mouth AOIs, a ‘heat map’ was created to highlight the areas that participants fixated on while looking at the face. Heat maps for older and younger adult participants were created for each age and sex of face. These maps were placed on a single face image for illustration purposes in Figures 6.7 - 10. While the majority of fixations occurred around the eye area in all categories of face image, other areas extending above the eyes such as the forehead appear to have drawn fixations by most participants as well as areas around the chin boss.
6.0 An investigation of visual scan participants for older and younger adults when evaluating attractiveness

**Older Adult Participant Heat Maps**

Figure 6.7: Older adult participant fixation heat map for younger face stimuli. Warmer colours indicate higher concentration of fixations. Younger female face based on 522 total fixations. Younger male face based on 486 total fixations.

Figure 6.8: Older adult participant fixation heat map for older face stimuli. Warmer colours indicate higher concentration of fixations. Older female face based on 521 total fixations. Younger male face based on 516 total fixations.

**Younger Adult Participant Heat Maps**

Figure 6.9: Younger adult participant fixation heat map for younger face stimuli. Warmer colours indicate higher concentration of fixations. Younger female face based on 516 total fixations. Younger male face based on 521 total fixations.

Figure 6.10: Younger adult participant fixation heat map for older face stimuli. Warmer colours indicate higher concentration of fixations. Older female face based on 515 total fixations. Older male face based on 536 total fixations.
6.0 An investigation of visual scan participants for older and younger adults when evaluating attractiveness

**Additional Analyses**

Based on inspection of the heat maps there appeared to be some tendency for older adults to fixate more frequently on the right side of the face more than younger adults. To examine these observations further a lateral comparison of fixations was made to see if older and younger adults differed in the number of fixations for the left or right of the face. Mean total number of fixations made on the right and left of the face images were compared for each group. A mixed ANOVA found no main effect of group \( F_{(1,20)} < 1 \). Similarly no main effect of side of the face was observed \( F_{(1,20)} < 1 \). Although no interaction was observed between group and side of the face, this was close to significance \( F_{(1,20)} = 3.70, p=.06 \). Means are plotted in Figure 6.11

![Figure 6.11](image)

**Figure 6.11:** Mean number of fixations for left and right side of the faces by the age of the participant. Although the difference was not significant the means here suggest that older and younger adults may differ in which side of the face they attend to more.
Finally based on an inspection of the heat maps the difference in lateral fixations for older adults appeared to be more evident in younger faces. The age of the face was included for analysis to see if this had any effect on participants viewing preferences for side of the face. A mixed ANOVA found no main effects of group, side or age of the face \( F(1,20) < 1 \). There was no interaction between side of the face and group, \( F(1,20) = 3.70, p = .06 \), age of the face and side \( F(1,20) = 2.785, p = .11 \), or age, side and group \( F(1,20) < 1 \). The means are plotted in Figure 6.12 below.

![Figure 6.12: Mean number of fixations for left and right side of the faces by the age of the face by the age of the participant. There was no significant difference in the side attended to based on the age of the face. SE bars of the mean are shown.]

### 6.4 Discussion

This aim of this study was to investigate how older and younger adults would evaluate faces when judging the attractiveness of faces of different ages. Specifically, I was interested in whether or not salient features such as the eyes and mouth would attract different types of eye scanning patterns. The findings here demonstrated that
6.0 An investigation of visual scan participants for older and younger adults when evaluating attractiveness

there were no overall differences between how younger and older adults evaluated faces for attractiveness as measured by number of fixations and the duration of those fixations. Similarly the age of the face stimulus did not significantly affect scan patterns in this way. However the results collected here indicated that for both younger and older adults the eyes attracted most of the visual fixations when evaluating a face for attractiveness, accounting for to up to nearly 60% of both total fixations and duration of fixations. This was the case for all ages and sex of face stimuli.

While some studies have indicated that older adults make fewer saccades and fixations when inspecting a visual scene (Munoz et al., 1998; Porter et al., 2010) and that even the range of ocular motion decreases with age (Clark & Sherwin, 2001) no such differences in number of fixations were observed between older and younger adults when attending to faces. These results suggest that faces may continue to be treated in the same manner in terms of scan patterns independent of age due to their important social nature in contrast to non-social stimuli.

Although the number of fixations across all AOIs appeared to be broadly similar for each age group of participant (see Figure 6.2), an inspection of the duration of fixations across older and younger faces suggest there may be subtle differences in how the age of the face affects its evaluation. From Figure 6.3, the eyes of younger faces appear to attract lower fixation durations than the eyes in older adult faces. Furthermore younger faces appear to attract a longer duration of fixation outside the eye and mouth AOIs suggesting that for attractiveness evaluations other features,
6.0 An investigation of visual scan participants for older and younger adults when evaluating attractiveness

such as skin clarity, may provide more valuable information when making an attractiveness judgment. An inspection of the heat maps in Figures 6.7 to 6.10 show that the area around the cheeks, forehead and chin boss attracted much of the attention outside the eye and mouth AOIs. In younger faces this may suggest that skin texture plays a role in attractiveness evaluations more than the mouth area. However it appears from Figure 6.5, that these differences in fixation durations are more pronounced in older adults attending to younger faces compared to younger adults attending to younger faces.

An examination of the heat maps created for each age group, although broadly similar, show some slight differences in exactly how older and younger adults scanned the faces. For example, while both groups did fixate primarily in the eye area, the distribution of their fixations in this area differed. In older adult participants fixation densities for younger faces tended more towards the right eye (from the perspective of the participant) more than the left, whilst in older faces concentrations appear to be more centrally located between both eyes. For younger participants the heat maps demonstrate that for all ages and sex of face the left eye (from the perspective of the participant) attracted more fixations. These heat maps may indicate that the actual scan patterns of this area may differ depending on the age of the participant, for example with older adult participants fixating more frequently to the right half of the face image and younger adult participants fixating more frequently to the left half of the face image.
Although analysis of number of fixations in these areas relative to the side of the face, the age of the face and age of the participant was inconclusive, this trend may be a reflection of an age related change in lateralization of visual perception. Using a sample of undergraduate participants, Burt & Perrett (1997) found that judgements of attractiveness and age in this sample of participants were biased towards the left side of the face image and a similar trend can also be seen in Figure 6.11. A number of studies have illustrated changes in visual perception as a function of age, with some pointing to a greater right hemispheric decline, which tends to be more involved in processing of visual information, in older adults (Dolcos, Rice & Cabeza, 2002; Sergent, Ohta & MacDonald, 1992). Such a decline in the right hemisphere may lead to greater influence of the information right visual hemifield as processed by the less age affected left hemisphere of the brain and may explain some of the bias seen by older adults to fixate more frequently on the right of the face image, also illustrated in Figure 6.11. Further testing on a greater number of participant as well as stimuli may reveal some significant differences in exactly how the face is scanned.

The results from Chapter 4 suggest that older adults rate all age groups of face stimuli as more attractive than their younger adult counterparts. While experience and attractiveness self-perception may have played a role in these evaluation differences, older adults may prioritise sexually selective traits differently as they age. Where an older face is being evaluated by an older participant, sexually selective traits indicating positive reproductive potential, such as clear skin texture and elasticity, may be discarded during evaluation because reproductive success is unlikely or irrelevant at that age. The results here may however indicate this evaluation of such
6.0 An investigation of visual scan participants for older and younger adults when evaluating attractiveness

features may be specific to the age of the stimulus. When evaluating a younger face where the individual is more likely to be reproductively able, features indicating good health such as skin texture and elasticity may remain important in the evaluation of attractiveness of the face. Although not significant, the trend in Figure 6.3, appears to indicate that older adults may evaluate features outside the eye and mouth AOIs, such as skin texture, differently depending on the age of stimulus.

One of the main aims of the current study was to determine any differences in scan patterns for older and younger adults when evaluating faces for attractiveness. While the results showed that older and younger adults appear to attend to the same features of the face when making these judgments they do not allow us to conclude that attractiveness perception is exactly the same for each of these groups. In their eye-tracking study Dixson et al. (2011) established that men evaluating female faces and bodies for attractiveness fixate more frequently and have longer duration of fixations on the breast region than any other regions of the body or head. They also demonstrated that the majority of fixations tend to be concentrated in the upper body including the head more than lower parts of the body such as thighs, waist, legs and feet. Dixson et al. (2014) later demonstrated the female participants' evaluated male attractiveness differently depending on the shape of their torsos and their distribution of fat. Although these studies both established that face and body are important for overall evaluation of attractiveness and that individual differences exist, their results stemmed from predominantly young adult participants and used the same face stimulus on each of their body stimuli. Despite there being no significant differences in how the age of the face or its relative attractiveness affected
6.0 An investigation of visual scan participants for older and younger adults when evaluating attractiveness

Scan patterns a more comprehensive approach, using faces and bodies, may yield a better understanding of how the age of the participant affects how attractiveness is evaluated. Other judgements relevant for attractiveness judgements such as masculinity and femininity that can be made using many of the dimorphic differences between males and females have also been shown to be affected by age the of the body as well as the age of the perceiver (Deutsch et al., 1986). Halliwell & Dittmar (2003) showed that while older men may have been unhappy with the reductions in their physical resilience as they aged, they regarded changes in their appearance neutrally or even in a positive manner. Interestingly other studies have shown almost a reverse of this trend in females as they aged, in that although they became increasingly dissatisfied with their appearance they reported increased satisfaction in their physical resilience particularly as it related to health issues (Hurd, 2000; Krekula, 2007). Clarke & Korotchenko (2011), however, pointed out that although ageing has been shown to affect self-perception and perception of others in terms of attractiveness the vast majority of these studies have concerned female participants and preferences and relatively little is understood in terms of male participants and ageing.

The external facial features that were eliminated from the current study in order to understand better how the eye and mouth regions were evaluated eliminated some key features used in determining the age of a person. The results of numerous studies, including the results established in Chapters 4 and 5 here, have shown that increasing age results in decreased ratings of attractiveness. However Perrett (2010) demonstrated that the perception of an individual's age can be driven by different
6.0 An investigation of visual scan participants for older and younger adults when evaluating attractiveness

sources and is normally judged on the ‘oldest looking’ feature of a person. The removal of external features such as hair and ears here may have removed features salient for making an age judgement which in turn may have affected how the faces were evaluated. Perrett pointed out that cartilage in areas such as the ears continues to grow throughout the lifespan making these features appear proportionately larger on older faces than younger faces, and that these features can contribute to age estimation.

The exposure duration chosen for the current study may have also impacted on the results observed here. A number of eye-tracking studies examining individual differences have used a range of stimulus durations (Bateson et al 2014; Janik et al, 1978). However studies in trait perception have shown that people can make a trait judgement, including attractiveness, where the stimulus exposure is extremely limited, in the order of 50-100msec (Borkenau et al, 2009; Willis & Todorov, 2006), and that these judgements remained stable even with unlimited viewing time. The results from Chapter 5 found that older adults were able to make trait judgements under time constrained conditions with these results being broadly in line with similar studies involving younger adults. However the results in Chapter 4 where participants of different ages were asked to rate the same faces on attractiveness after an exposure duration of just 1sec found that older adults arrived at significantly different evaluations of those faces compared to their younger counterparts. The extended stimulus duration used here may have masked any differences in how older and younger adults evaluated faces early on in the presentation with the additional time simply building up the number of fixations in eye or mouth areas which would
6.0 An investigation of visual scan participants for older and younger adults when evaluating attractiveness

naturally have drawn attention anyway. In their studies, Dixson et al. (2014) found that across duration of their exposure that certain features attended to during the first 2 sec of were paid significantly less attention in the latter portion of the exposure time and found that these early data were more indicative of individual differences. It may therefore be useful to either reduce the exposure of the stimulus duration compared to that used in the study here or to segment the analysis into different time brackets to examine any potential differences between younger and older adults.

While I expected the mouth to be an important area of interest for evaluations of attractiveness due to its ability to indicate age, health and symmetry, the high number of fixations and duration of fixations in other regions of the face indicate that participants used information from outside the mouth and eye areas to inform their judgements of attractiveness. All face stimuli used here projected a neutral expression. Emotional expressions have been shown to influence ratings of attractiveness with smiling enhancing female attractiveness and pride enhancing male attractiveness (Tracy & Beal, 2011). Where no emotional expression is available to the perceiver to relay social information such as reciprocity of interest (e.g., in a smile) or to indicate threat or aggression (e.g., angry expression) other indications outside of the mouth area may be sought to inform an evaluation of attractiveness. The results here may support the idea that the importance of the mouth area in attractiveness evaluation can be affected by the type of expression displayed, however, further testing using a variety of expressions is needed to support this conclusively.
6.0 An investigation of visual scan participants for older and younger adults when evaluating attractiveness

It is clear from the results collected here and in previous chapters that the face and in particular the eyes heavily dominate in evaluations of attractiveness for both older and younger adults. An understanding of age differences in attractiveness perception could be further improved by specifically targeting the eye region and incorporating emotional expression or eye specific properties such as gaze direction.

6.5 Conclusion

The current study aimed to examine how older and younger adult participants would evaluate faces for attractiveness by using eye-tracking as a measure of what features of the faces were being scanned. Specific interest was given to the eye and mouth regions as they have previously been shown to be central cues in the face for both attractiveness evaluations as well as age estimation (Hassebracuk, 1998; Henderson, Williams & Falk, 2005; Janik et al., 1978; Williams & Henderson, 2007). The results indicated that there were no significant differences in how the age of the participant affected how they scanned a face or these AOIs. For both older and younger adults the eyes attracted the greatest number of fixations, as well as longer fixation durations, suggesting that in the face the eyes are the most informative feature for making judgements of attractiveness. Although no statistically significant differences were observed for the age group of participants, heat maps generated by each group’s fixation patterns appear to show some differences in how the eyes were scanned with some tendency for older adults to fixate more frequently on the right eye but with younger participants appearing to fixate more frequently on the left eye. This pattern may be part of an age related change in lateralization of visual perception.
7.0 General Discussion

The current chapter summarises the main findings from each of the preceding experimental chapters. These findings will be discussed in terms of their wider theoretical implications. Finally some of the questions and limitations that have arisen as a results of these findings will also be discussed as well as the practical implications and possible future directions.

7.1 Summary of Results

In Chapter 2 the role of vocal information presented concurrently with a face image was investigated to examine how it impacted on the evaluation of that face in terms of attractiveness. Specifically the role of humorous and non-humorous vocal content was investigated. The results suggested that face images presented concurrently with humorous statements were rated as being significantly more attractive than faces which were presented with no vocal content, suggesting that an individual may enhance their attractiveness by demonstrating their ability to produce humour. Interestingly however no significant difference between the ratings given to a face presented with humorous statements and face presented with non-humorous statements was observed. While female faces across all conditions were rated as being more attractive than male faces no interaction between the sex of the face and vocal condition was observed. Similarly male and female participants evaluated faces in a similar way across each vocal condition, regardless of the sex of face. These results contrasted with a previous study by Bresler & Balshine (2006) who found that
mens' and womens' perception and appreciation of humour production was different depending on the sex of the face. This study differed from previous ones examining humour and attractiveness by presenting multisensory information and the results found here suggested that humour is evaluated differently under these circumstances. The results also suggested that attractiveness and humour may be influenced by the context in which it is presented, in this case with non-humorous and vision only conditions.

The experiments reported in Chapter 3 investigated the role of familiarity in evaluations of attractiveness. This series of experiments set out to specifically investigate whether or not the mere exposure effect (MEE) would occur with different facial expressions and if the effect could be achieved outside the usual experimental paradigm that is often used to observe this effect. Results indicated that the MEE does occur across different types of facial expressions even if those facial expressions are negative, (e.g., angry). Experiment 1 found a modest increase in attractiveness ratings across all facial expressions for the face stimuli that were presented more frequently. Experiment 2 repeated the same procedure as Experiment 1, however, here I changed the image of the face identity that may have been seen during the exposure phase with a facial expression such as happy or angry to an image of the same identity but in a neutral expression. This aimed to test if the MEE was image or person dependent. The results found a modest MEE for faces that had been seen more frequently, however, this effect was not as strong as that found in Experiment 1 and required many participants. This result indicated the MEE may be primarily image based and does not easily transfer across different images of the
same person. In Experiments 3 and 4 I manipulated the classic MEE experimental paradigm further by examining if the proportional amount of frequency of exposure and whether or not a continuous presentation of the stimulus could achieve a similar effect. No MEE was found in either of these experiments indicating that the MEE may not be malleable enough experimentally to induce the effect under a variety of conditions. However compared to a baseline study where the face images used in these experiments was shown only once and for a short duration and then rated, all four experiments where the duration of exposure was higher and more frequent showed higher ratings for those same faces. These results indicate that increased mere exposure is sufficient to enhance attractiveness evaluations but that the MEE may have limited applications outside a very specific experimental set up.

In Chapter 4 the role of ageing and attractiveness perception was addressed across different ages of participant and stimuli as well as across visual, auditory and audio-visual modalities. The greater part of research concerning attractiveness perception has predominantly relied on young adult participants evaluating young adult stimuli. Here I asked participants of three different age groups, specifically younger, middle and older aged participants to rate the attractiveness of faces, voices and face-voice combinations of a set of stimuli of similar age brackets. The results from these experiments showed that the age of the participant influenced how they rated stimuli for attractiveness. It was found that older participants gave significantly higher ratings to visual and audio-visual stimuli than their younger or middle aged counterparts. There was also a trend for middle aged participants to give higher ratings to these same stimuli than their younger counterparts, though this was not significant. The
results across from these experiments also revealed that all age group of participants are driven primarily by visual information in their evaluations of attractiveness. The difference in evaluations of attractiveness by older adult participants may be as a result of experience of changing perceptions of their own attractiveness as well as a change in their definition of what is actually attractive where biological motivations such as reproducing are less relevant.

The results from Chapter 4 were extended to examine how older adults would evaluate faces and voices on a number of trait dimensions, including attractiveness, competence, distinctiveness, dominance, familiarity and trustworthiness. It has been widely shown that we make such inferences very quickly about people upon meeting them and these inferences can have important social impacts in terms of our evaluation of them. Furthermore these traits have been found to correlate with each other either positively or negatively. Again however, much of the research concerning trait perception and correlations has relied on the responses drawn from younger adult participants and younger stimuli. Here I asked older adult participants to rate faces and voices on the trait dimensions outlined above and presented them in a manner similar to studies using younger adult participants. In addition, these trait ratings were carried out on three different age groups of stimuli to establish if trait perception of an individual is influenced by their age. The results showed that older adults could easily make trait judgements under constrained time and that some of these traits correlated with each other. While the direction of these correlations was similar to those found in studies with younger adults, the strength of these correlations was in some cases weaker, particularly those correlated with
attractiveness. This may suggest that as a person ages and their evaluations and definitions of attractiveness changes, so too may their corresponding correlations with traits such as dominance. Furthermore this study also established that some correlations appeared to be specific to certain age groups, suggesting that the age of the stimulus also affects how it is evaluated. Correlations between traits were also more numerous in the visual condition suggesting that evaluation of trait dimensions may be visually dominated.

The results from Chapters 4 and 5 demonstrated differences between older and younger adult's evaluations of attractiveness and its correlated traits. As it appeared that both groups relied predominantly on visual information when making these evaluations I sought to directly test how each group inspected faces during these decisions. Through the use of eye tracking measures, older and younger adults inspections of faces of different ages were measured in terms of their number of fixations and the duration of these fixations in areas known to be important in perception of age and for judging attractiveness, specifically the eyes and mouth areas when attractive and unattractive faces were viewed. No significant differences were observed between older and younger adult in how they evaluated faces differing in attractiveness as determined by these measures. However some subtle variations in scan patterns appear to present on inspection of heat maps created to represent viewing patterns. Older adults had a tendency to fixate more frequently on the right eye of the image in particular for young faces, whereas younger adults appeared to fixate more frequently on the left eye of all ages of face images. Although not significant there also appeared to be a tendency for older adults to spend longer
durations fixating outside the eyes and mouth areas on younger faces more than older faces.

7.2 Implications of findings

The chapters in this thesis can be broadly divided into three separate subjects, the role of semantic content in speech and its impact on attractiveness, the role of frequency of exposure on attractiveness and the role of ageing on attractiveness and other trait evaluations. In the following sections the results of each of these will be discussed in terms of their implications for the wider field of attractiveness research.

7.2.1 Humour

Humour has repeatedly been shown to be an important characteristic in attraction (Bale, Morrison & Caryl, 2006; Bresler & Balshine, 2006; Coates, 2007; Greengross & Miller, 2011) and this was also found to be the case in Chapter 2 of this thesis where individuals associated with humorous statements were rated as being more attractive than those associated with non-humorous statements. However no significant difference between attractiveness in either of these conditions was observed compared with a control vision only condition. Surprisingly many of the studies testing humour and its effect on attractiveness ratings (Brand et al., 2012; Bresler & Balshine, 2006; Bresler et al., 2006; Cann & Matson, 2014) have failed to use such a control, instead testing humour directly against non-humour or using various levels of or types of humour (e.g., high/low). This dichotomous approach may be useful in understanding relative differences in humour and non-humour but does not accurately reflect how humour is assessed in reality, where we may be exposed to a
7.0 General Discussion

group of individuals each contributing in different ways. Furthermore these types of studies also tended to use text based or questionnaire type approaches to addressing the role of humour on attractiveness. In the study presented in Chapter 2 I attempted to address some of these issues by using a broader context and including a vision only condition as well as using vocal samples to deliver the humour/non-humour information. Although this approach also illustrated a significant difference between humour and non-humour on attractiveness, under these conditions faces that were seen with no vocal information were rated as being equally attractive to two vocal conditions. While it can only be speculated whether or not there may have been a significant difference had there been a two condition only version of the experiment (e.g., humour versus vision only), the results from Chapter 2 suggest that context and comparison may have played a role in the overall evaluation of humour and is not simply a matter of humour versus non-humour.

While the delivery of humour/non-humour was done using vocal clips so as to allow the participant attend more easily to the face, the type of humour used in these clips was specifically selected because it could be delivered in a vocally neutral way and remain humorous. Cann & Matson (2014) illustrated that the style of humour also effects how a person is evaluated. In their study they found that different styles of humour, such as self-enhancing, self-deprecating, aggressive or affiliative, led to differing evaluations with some styles being more socially desirable than others. Furthermore some types of humour, particularly when delivered through speech, rely on other vocal cues such as timing or cadence. These types of cues also require some type of comparison to regular speech patterns in order to better discern the type of
semantic content being delivered. Combined with the results from Chapter 2 this also illustrates the prominence of context and comparison in evaluation of humour and that such considerations should be made for any future studies seeking to better understand the role of humour and attractiveness.

7.2.2 Exposure & Attractiveness

Since Zajonc's seminal 1968 study on the MEE was published, it has received thousands of citations and has appeared as an explanation for increasing appeal of stimuli across many platforms from introductory psychology books to popular media. The repeated replication of this effect makes it difficult to argue the claim that simply increasing exposure to a stimulus does in fact lead to increased liking for that stimulus. Indeed the broad pattern of results from Experiments 1 – 4 in Chapter 3 indicated that the stimuli observed there, which were seen more frequently or for a longer duration, received higher ratings than those same faces which had been seen only once for a brief duration in the online rating study.

In his original paper, Zajonc made no distinction between the MEE for a face or for any other type of stimulus. Indeed while most studies examining attractiveness and the MEE have assumed no difference between how it occurs for faces or other objects, Seamon, Patricia & Binder (1998) argued that the effect may be sensitive to different types of judgement tasks. In addition many studies have highlighted the fact the effect is at its strongest or achieved more easily when the stimulus is presented for extremely short durations (Bornstein, 1992; Murphy, Monahan & Zajonc, 1995; Young & Claypool, 2009). In reality faces are rarely encountered at such extremely
short durations and furthermore are known to be unique in how they are processed in the brain compared to other objects (Bruce & Young, 1986; Quinn & Macrae, 2011), additionally they may also possess certain properties that cannot be shared by other objects, such as expression.

The findings from Chapter 3 highlight some of the difficulties making the MEE more generalizable for faces. Few studies measuring the MEE have conducted their experiments in naturalistic settings and many tend not to use stimuli that have personal relevance for the participants. Furthermore most studies tend not to reflect the complex nature of human interactions. In making changes to the classic experimental design, the studies in Chapter 3 revealed that even simple deviations, such as expression change or relative amount of expression, resulted in a weakened or no effect. These results suggest that in the context of an experimental setting that the MEE was more likely to be image dependent rather than person dependent. This of course does not reflect how attraction may exist in the real world where we are exposed to different expressions or viewing angles of a face and yet still manage to increase our liking of a person. Furthermore these interactions tend to occur over much longer periods of time and typically last longer than the exposure durations used in most studies.

One of the main explanations for the MEE is in terms of some type of positive affect in response to a stimulus that is more easily recalled or processed. However in nearly all examinations of the MEE in terms of facial attractiveness have used stimuli that are unknown to the participant and whom they are not expected to actually interact
with. Encountering a face in reality on repeated occasions may result in the type of positive affect outlined in the leading theories, however where repeated encounters are expected to occur with an attractive face this may have a greater positive affect (Aharon et al., 2001). Furthermore it cannot be discounted that where a relationship with that person may become a possibility that this may further enhance liking for that person.

Curiously, expression had relatively little impact on the ratings made across the four experiments in spite of numerous other studies showing that it can have significant positive and negative effects on attractiveness (Doherty el al., 2003; Jones et al., 2006; Mueser et al., 1984; Tracy & Beal, 2011). Under the conditions of these experiments it appeared that frequency was more important in enhancing attractiveness. However the type of stimuli used here and in most examinations of the MEE fail to take into account the temporal nature of an actual expression. Images used in the majority of studies, including the ones here, often capture the expression at their apex (e.g., full smile), and fail to take into account the temporal nature of how an expression actually occurs with an onset from neutral to the full expression and offset as it returns to a neutral or resting state.

Based on some of the findings from here and in other studies, it appears that the exact mechanism driving the MEE to faces and objects share at least some overlap in terms of perceptual fluency. However in order to better understand attractiveness as a function of exposure it may be useful to consider the special nature of faces both in social terms as well as the real world temporal dynamics of how that exposure
actually occurs. The current understanding of the MEE and its restricted experimental paradigm allows for few real world inferences of what really drives attraction to faces based on these very short durations and use of novel images.

7.2.3 Ageing

The role of ageing has been shown to make a significant impact on how attractiveness is evaluated, this was particularly evident in the studies in Chapters 4 and 5. The vast majority of research focusing on individual differences in attractiveness have tended towards dimorphic differences between males and females and in particular how these relate to reproductive success. This is understandable as both sexes naturally differ in their approach and responses to reproduction.

While ageing of the participant has traditionally been over looked as an important component in attractiveness evaluations due to differences in biological imperatives, based on the results here and shifting cultural and practical concerns it may now be more important to reconsider the role of the participants age. The results from Chapter 4 showed the evaluation of attractiveness may begin to change during middle age, where middle aged participants showed a trend for giving higher ratings than their younger counterparts. In recent times longer lifespans and changes in financial security have resulted in individuals starting serious relationships later and delaying having children, with a report from the Office for National Statistics in 2013 in Britain indicating that in the past 30 years the average age for a mother giving birth has risen from just under the age of 25 years to just over 30 years of age. While the traditional indicators of attractiveness such as averageness, symmetry and
reproductive health will likely still play a role at this age, the consequence of some of these cultural shifts may also begin playing a larger role in overall evaluation of attractiveness even in early middle age. Most interestingly however is that this delay in reproduction may itself be influencing the evaluations of attractiveness made by offspring.

Perrett et al. (2002) conducted a study asking if children born to older parents differed in their evaluation of attractiveness of others compared with children born to younger parents. While these undergraduate participants were found to be most attracted to their peers, students who were born to parents who were over the age of 30 at the time of their birth, were found to be much more attracted to older faces than their counterparts. Students whose parents were older when they were born also paid less attention to age related details such as skin texture, wrinkles etc. The results from Chapters 4 and 5 as well as studies such as that of Perrett et al., show that the role of ageing is not only a prominent aspect of attractiveness and trait evaluations, but may in fact be difficult to entirely discount from what we currently understand about these types of preferences. What we currently understand about attractiveness has primarily been gained from younger adult participants over the past 40 years or so. However, rapid changes in social and economic circumstances since then should be considered for any future investigations regarding attractiveness and trait evaluation in general.

Similarly the results from Chapter 5 showed that older adults made similar trait judgements to younger adults and that there were numerous correlations across the
different dimensions. In the broader sense of attractiveness research this indicates that attractiveness evaluations are not likely to occur in isolation and that other inferences are made simultaneously using the same physical information from the face or the voice. This however is rarely addressed in attractiveness studies outside those specifically measuring its relations to other traits.

7.4 Likert Measurements

Throughout the many studies addressing research questions on attractiveness it has been common to use Likert type scales (LTS). Similarly these types of scales are found throughout the experiments reported here and as such it is worth discussing the justification and relative merits of such an approach to the study of attractiveness.

Attractiveness is not a dichotomous property where a person is or is not attractive, some people we are attracted to more than others. Attractiveness is a continuum ranging from highly appealing to highly unappealing therefore an approach such as a two alternative forced choice (2AFC) for example, may not always be a useful paradigm for measuring certain aspects of attractiveness. The use of LTS allows the respondent to choose the level to which they agree that a person is attractive or unattractive, i.e. the strength and direction of their preference. Likewise it also accommodates neutral answers where the respondent has no particular preference (where the scale has an odd number of points e.g. the 7 point scales used here), something a 2AFC design would not allow us to conclude.

A further advantage of such scales is that their ubiquitous use in other areas of day to day life means that they are easily understood and used by participants without
the need for lengthy explanations or extended practice trials to ensure the participant has understood, (Jaeschke, Singer & Guyatt, 1990; Vickers, 1999), this is particularly useful when measuring something like trait perceptions in Chapter 5, where the participant is familiar with the method of measurement but may not have ordinarily come across the specific question before. Data collected from such methods lends itself to a multitude of statistical analyses.

There are, however, a number of difficulties in using such methods. Firstly, there is often a tendency for participants to give scores that are in the middle of the scale. Likewise participants are often disinclined to give scores at highest and lowest ends of the scale, possibly so as to appear more socially desirable by not being overtly positive or negative in their evaluation of others (Garland, 1991). This further limits the amount of scores available for analysis and may not be a true reflection of a participant’s actual evaluation of the person or question.

Additionally the problem in using such scales is that responses given by a participant may influence later responses, for example where a participants feels they have given too many of one particular responses they may arbitrarily choose to use another in order to try and balance their responses, (Chan, 1990). Similarly responses given near the beginning of an experiment may not accurately reflect a participant’s attitude towards a particular stimulus as they have no initial frame reference by which to evaluate the stimulus. Accordingly stimuli appearing near the end of an experiment will have an extended frame of reference and may be evaluated differently compared to those at the beginning. While this can be addressed by counterbalancing, as used
in many of the experiments reported here, arguably however, there remain a number of stimuli near the beginning of the experiment that are rated free of the frame of reference that later stimuli are judged.

While the advantages outlined above and their widespread use throughout the field of attractiveness research encouraged the use of LTS in many of the experiments reported here, certain additional measures could be employed in future studies to augment the results. The recording of response times may shed further light on how a stimulus is judged. For example, reliability of responses to a particular stimulus could be further enhanced by comparing whether or not participants were also similar in how quickly they made that response. Although this approach may not have been useful for some experiments, such as those carried out in Chapter 3 due to the long and fixed duration of the rating picture, it may further enhance our understanding of how participants approached ratings in other chapters particularly the cognitive dimensions measured in Chapter 5. While not necessarily applicable to the majority of studies presented in this thesis, the application of a 2AFC approach in Chapter 3, perhaps as a follow up method, may have yielded additional information on how the level of exposure affected the preference for one frequency over another.

Given the predominance of visual information when judging attractiveness additional methods specific to that modality would also greatly improve our understanding of attractiveness perception. This was addressed in the final experimental chapter in this thesis through the use of eye tracking technology. Manipulation of certain visual features and subsequent analysis through eye tracking may yield looking preferences
7.0 General Discussion

or relative importance of such features for judging attractiveness. Such methods could prove useful in addressing the type of questions posed in Chapter 3 where the contribution of expression and its relative frequency remained somewhat unclear. Other methods specific to visual information such as binocular rivalry may also be valuable in understanding how certain faces or features dominate in conscious perception when evaluating attractiveness.

7.5 Exploratory Analyses

Throughout many of the studies presented in this thesis additional exploratory analysis was performed in addition to the main research question posed at the beginning of each chapter. These included analyses to discern any effect caused by the gender of the stimulus or the participant, or other factors such as the relative attractiveness of one group of stimuli versus another. To some extent this approach was shaped by the ability or likelihood of obtaining sufficient data or participants to allow for a certain analysis. For example, while obtaining a reasonably balanced number of male and female was in fact achieved in many of the experiments carried out in Chapter 3 and could have been integrated into the initial research question, the ability to obtain sufficiently balanced numbers of participants in later chapters, for example, those concerning between age group difference, was much less clear. While it may be argued that such an approach amounts to cherry picking of the data, the research questions posed in each chapter were designed to specifically address some of the wider objectives of the Captavatar project, though the additional
analyses were not specifically pre-specified in the main question posed, given the nature of the subject, it would be a missed opportunity not to extend the understanding of the main results in a broader context. The vast majority of studies concerning attractiveness focus primarily on inter gender preferences therefore a complete absence of any such exploratory analysis would fail to elucidate the findings in the broader context of attraction. Similarly analyses addressing relative attractiveness are also important due to the non-dichotomous nature of attractiveness where certain faces may be evaluated differently depending on their relative attractiveness. Finally the additional exploratory analyses should prove informative for the design and specification of any future experiments concerning similar questions.

7.6 Theoretical Implications

While certain aspects of attraction will remain relatively constant and are resistant to rapid change, arguably the way in which attractiveness evaluations are made have changed very rapidly in the recent past.

Despite a wide ranging body of literature concerning attractiveness evaluations and perceptions, there typically exists a common underlying explanation for these preferences in the form of biological and evolutionary adaptations. It is difficult to argue against these explanations, simply because it is in the species nature to want to reproduce and they appear to be applicable throughout most, if not all, human cultures, for example preferences for averageness or symmetry. Furthermore the
pace at which evolution occurs also means that such preferences are deeply ensconced in our biological make up and history and resistant to rapid change. While this may true of our biological make up, our cognitive processes should be more quickly adaptable. Indeed one of the key explanations for the MEE is that the stimulus becomes easier to appraise or process because of recall and perceptual fluency.

For the greater part of human evolution, evaluations of attractiveness have been done while in proximity to the actual person. With the advent of recorded images and sound in the past 150 years we have become increasingly accustomed to making attractiveness evaluations on a much greater number of individuals than ever before in human history, even more so in the past 10 to 20 years with access to images and sounds via the internet. While 150 years of increased amount of exposure to faces or voices is unlikely to have resulted in biological priorities changing in terms of attractiveness, the cognitive processes for making these judgments may be more easily modified.

The studies conducted here showed the participants readily made evaluations of attractiveness for individuals with whom they were unfamiliar with and with whom they would have no expectation of real interaction. Whereas in the past a single physical interaction with someone was matched to a single cognitive appraisal, this ratio has changed dramatically in recent times. We both actively and passively consume information about individuals relevant for attractiveness judgements in the absence of any expected interaction, and may make hundreds of such judgments on a daily basis.
In other areas of information processing or learning, schema are often employed to reduce cognitive loads or stresses in presence of large amounts of information (Sweller, Ayres & Kalyuga, 2011). The levels of processing theory put forward by Craik & Lockhart (1972) proposed that the amount of attention and perceptual processing operating at the time of exposure can determine the 'depth' at which it is encoded. ‘Depth’ refers to the meaningfulness extracted from that stimulus rather than how many times it may have been analysed and stimuli that have received a greater depth of processing can produce more elaborate, enduring and stronger memory traces. While this theory is relatively simplistic and has received numerous revisions (Craik & Tulving, 1979; Eysenck, 1979; Hyde & Jenkins, 1974), the core idea of a stimulus having more of an impact on behaviours or attitudes depending on how well it remembered, encoded or how meaningful it may be, persists in other theories and studies (Baddeley, 2003; Keyes, Dlugokencka & Tacel, 2013; Paivio, 1990;)

Every day we encounter potentially hundreds of faces or voices that we may judge to be attractive or not, however it seems unlikely that this number of stimuli would all be specifically attended to, much less processed with any depth. What is more likely is that many of these judgments are done without any great cognitive effort and are relatively meaningless beyond the time spent observing them, unless that stimulus contains some sort of relevance or interest for the person evaluating, perhaps in the form of actual interaction or expected future interactions with the person being evaluated.
It may be important to consider whether or not an evaluation of attractiveness made under laboratory conditions, such as the ones made in the studies presented here, can or should be explained in terms of cognitive mechanism such as the one we may employ for evaluating the constant stream of faces or voices we encounter.

**7.7 Future studies**

Based on the findings of the current set of studies there are numerous potential avenues of further research that would expand on our knowledge of attraction. One of the key findings in Chapters 4 and 5 was that older adults appear to differ from younger adults in their evaluations of attractiveness. Older adults gave more positive evaluations to faces of all age groups of stimuli compared to younger adults. There are clear structural differences between older and younger faces caused by things such as skin elasticity, blood flow, fat distribution etc. In older faces the reduction and change of these leads to features looking less symmetrical than they would be on younger faces or skin looking less uniform. However while these changes lead to more asymmetries and further deviation from the average, the results here suggest that older adults may be less concerned by these changes than their younger counterparts.

These findings can potentially be extended to other areas of perception for example aesthetic preferences for non-biological stimuli. Jacobsen et al. (2006) demonstrated that judgments of highly symmetrical patterns correlated strongly with how appealing that pattern was perceived to be. However here the results were based on participants with a mean age of around 25 years. The results from Chapters 4 and 5
could be extended in these types of studies by including older adult participants to
determine if symmetry remains important to aesthetic judgments in general and not
just faces.

In turn it may also be advantageous to use some of the findings from the field of
aesthetic preferences in perception of attractiveness in humans. In Chapter 3 the role
of perceptual fluency was discussed in relation to how it affected the liking for a
stimulus with the concept being that a stimulus that is more easily processed or
recalled may result in an increased liking for that stimulus over another which was
not as easily processed or recalled. For example, one of the explanations for the
results in the Jacobsen et al. (2006) study was that symmetrical patterns were easier
to process than asymmetrical ones; this explanation has also been used to account
for preferences in faces that are highly symmetrical. Other studies in aesthetic
preferences have shown that curved objects were preferred over objects with more
jagged contours (Bar & Neta, 2006), simple shapes with high contrast were preferred
over similar shapes containing low contrast, (Reber, Winkielman & Schwarz, 1998)
and that more frequently seen text characters were preferred over less frequently
seen ones (Zajonc, 1968). In these cases perceptual fluency was argued as being the
reason for these preferences, with one set of stimuli being processed or recalled more
easily than the other. It may be useful to specifically investigate the effect of
perceptual fluency on some of the results established in this thesis. For example
where a younger face is preferred over an older one, is this as a result of differences
in features indicating good health or reproductive ability or as a result of one face
being more processed than another. Similarly it may be useful to investigate if
perceptual fluency accounts for any of the variation in results established for older versus younger adults. Older adults will likely have encountered faces of different ages more frequently, including their own, than younger adults, this therefore may result in some perceptual fluency when evaluating older faces compared to younger adults who may not have had the same frequency of exposure to faces of different age groups.

7.8 Practical Implications

The studies conducted here were designed to address some of the wider questions and objectives of the 'Captavatar' project. One of the main goals of this project was to create a virtual human that was appealing and engaging to interact with. The purpose of this goal was to be able to use these virtual humans in practical applications, for example educational or health interventions, where there may simply not be the resources for real human interactions. A number of studies have demonstrated that engagement with an individual in these types of settings such as with a teacher or health care professional has a significant positive impact on the individual's ability to learn or to promote patient recovery (Alborz et al., 2009; Giangreco et al., 2001; Stewart, 1995) and that early impressions between individuals in these settings can be important for promoting overall engagement (Ruusuvuori, 2001). In recent years a growing number of efforts at using technology in such interventions have been attempted (Ni, Karlson & Wigdor, 2011; Tancredi et al, 2013) but have not gone to the extent that is being addressed in the Captavatar project.
One of the positive ways to achieve the goal of creating an engaging and appealing virtual human is through the study of attractiveness to understand what kind of information we use to make an evaluation of attractiveness, particularly in terms of visual and auditory information. Attraction is the initial basis on which we form the vast majority of our friendships and relationships and as such having a greater understanding of what drives this process can inform how best to create this virtual human. One of the key findings in this thesis was that older and younger adults differed in their evaluation of attractiveness, particularly of visual stimuli. Younger adults gave significantly lower scores to all age groups of stimuli than their older counterparts suggesting that what is attractive to one group is not necessarily attractive to the other. Where a virtual human is concerned it may be necessary to create different versions depending on the age group of participant it is intended to interact with. From the results in this thesis it appears that younger adults may have a much narrower band of what they consider attractive, subsequently it may advantageous to manipulate the averageness and symmetry of the face to enhance its appeal to a younger individual.

While it may be argued that such a manipulation is likely to also appeal to older adults and therefore not require the construction a separate virtual human, the results from Chapter 5 indicate that older adults may form trait impressions differently than younger adults and that the strength of correlation between some of these traits are different. It was argued in this chapter that older adults’ definition of attractiveness may change as a results of experience, self-perception or biological motivations. Consequently the relationship between traits typically correlated with attractiveness,
such as those seen in the 'halo effect', may also differ. For example the correlation between attractiveness and trustworthiness found in older adults is moderate overall but was particularly low for younger face stimuli. Manipulating features such as averageness and symmetry of a face to make it more appealing are also likely to make that face appear younger (Fink, Grammer & Matts, 2006) which in turn may lead to a lower trustworthiness evaluation. Where engagement and positive early impressions are important, it may be more advantageous to retain features that appear to make the face look older so as to enhance how trustworthy it is perceived to be.

One of the key themes to emerge in the studies in this thesis is that attractiveness is not simply limited to the physical structures of a face or the characteristics or tone of a voice. Throughout each of the chapters it has been illustrated that attractiveness of a face or voice is dependent on many additional factors and appears to be a fluid and adaptive process. To date however research in the area usually tends to remain focused on one aspect usually as result of practical considerations. For example dynamic face or voice stimuli can be difficult to acquire or control for, similarly it may not be practical to test a participant over several experimental sessions or long periods of time. In the scope of a project like Captavatar it may be possible to mitigate some of these concerns and gain a greater understanding of attractiveness by using these virtual humans to incorporate some of the features found in naturalistic evaluations such as motion, speech, expression etc. While it can be argued that this potentially limits the ecological validity of any findings it nonetheless offers the opportunity to examine the features outlined above both individually and collectively.
and offers a flexibility that cannot be applied retroactively to recorded stimuli of real people.

7.9 Synopsis

The experiments carried out here have contributed to the understanding of how visual and auditory information are used in evaluations of attractiveness. The findings presented here suggest the visual and auditory information may be used differently depending on the exact content or context of the evaluation but that we are primarily driven by visual information when making such judgements. Furthermore these judgements are subject to individual differences depending on the age of both the stimulus and the participant.

The findings from Chapter 2 illustrate the importance of semantic content in speech when evaluating attractiveness. Chapter 3 found the MEE may not be as robust when manipulations are made to the experimental paradigm highlighting its limitation in understanding attractiveness as well as having limited practical applications. The remaining chapters dealt with the effects of ageing on attractiveness and trait evaluations both of the stimulus and the participant which is vastly underrepresented in the current literature. These chapters concluded that older and younger adults differ in how they evaluated attractiveness indicating that the perception and even definition of traits such as attractiveness may be fluid in nature and change in response to ageing, particularly ageing of the participant.

Some potential new avenues of investigation to better understand how unisensory and multisensory evaluations of attractiveness are made are also outlined here.
Advances in stimulus production, such as those being carried out by the Captavatar project, could potentially allow evaluation of multiple factors contributing to attractiveness judgements.

While many of the studies in this area of research have found explanations for attractiveness in long established biological processes and preferences, the recent and rapid evolution of different types of media and social platforms may mean that the role of cognitive processes are contributing more to evaluations of attractiveness than ever before. It is hoped that the studies and results presented in this thesis will make a meaningful contribution to the area of attractiveness research and point towards effective future investigations.
References


Brand, R. J., Bonatsos, A., D’Orazio, R., & DeShong, H. (2012). What is beautiful is good, even online: Correlations between photo attractiveness and text attractiveness in men’s online dating profiles. Computers in Human Behavior, 28(1), 166-170.


Brooks, R., & Kemp, D. J. (2001). Can older males deliver the good genes?. Trends in Ecology & Evolution, 16(6), 308-313.


References


References


References


References


Appendices

Non-humorous statements

When I take notes in class, I use different coloured pens to keep the topics organized.

I run 3 kilometers 3 times a week.

My favourite television show is ER.

I'm late to class at least 3 times a week.

I watch at least 2 hours of TV every night but it's mostly the Discovery channel.

My favourite day of the week is Thursday.

I wake up early on the weekend so I can get my work done by noon.

I always hold doors open for people.

I read a book a week.

I usually study until 1 in the morning and wake up at 6 in the morning.

I enjoy giving people directions when they're lost. It's a quick easy way to help someone out and that feels good.

I put 30 euro into a savings account every week so that I can buy a house when I graduate. I've been doing this for 8 years now.

I always call my mother after I've taken a long trip so she knows I've made the trip ok.

My favourite author is Hemmingway. I like the way he ends his books by changing the storyline at the last minute.

I'd rather walk to school than take the bus. It's nice to get the exercise.

I used to write for a local newspaper. I enjoy expressing my opinion to people.

I do my school assignments in coffee shops.

I like to go to chapters and read new books.
Humorous statements:

I wrote a song once, but since I can't read music, I don't know which song it is. When I listen to the radio, sometimes I wonder if I'm hearing my song.

I heard on the news the other day that 1 in 5 people in the world are Chinese and there are 5 people in my family, so one of them must be Chinese. It's either my mum, my dad, my older brother Colin or my younger brother ho cha chu. I think it might be Colin.

I think my favourite joke is "two sausages are in a frying pan, one looks at the other and says whew it's hot in here, then the other sausage says oh my god its a talking sausage.

Why do toasters have a setting that burns the toast to a horrible crisp that no one would eat?

I was thinking about life the other day and a frightening thought occurred to me, what if the hokey pokey really is what it's all about.

My computer broke over the weekend. Without email I have no idea what's happening with my friends or family. Can anyone remind me how a phone works?

I like the lottery because it's basically a tax on people who are bad at maths.

My grandfather had a saying that I think describes most of life. Some days you are the pigeon some days you are the statue.

I have a deep fear of clowns. I've thought a lot about this and I think it goes back to my childhood when we went to the circus and a clown killed my dad.

Birthday cake is the only cake you can blow on and spit on and everyone rushes to get a piece

The high school I went to was so rough we had our own coroner. We used to write essays like what I want to be if I grow up.
As the poet said "only god can make a tree", probably cos it's hard to figure out how to get the bark on.

I am not afraid of death I just don't want to be there when it happens.

I believe there is something out here watching us, unfortunately it's the government.

I don't to achieve immortality thru my work, I want to achieve it through not dying.

I have bad reflexes I was once run over by a car being pushed by two guys.

When I was kidnapped my parents sprang into action. They rented out my room.

You can live to be a hundred if you give up all the things that make you want to live to be a hundred.
7th February 2012

F.A.O. Brendan Cullen

School of Psychology Research Ethics Committee

Dear Brendan,

I am pleased to inform you that your application entitled "Laugh in the Lab" has been approved by the School of Psychology Research Ethics Committee.

Yours sincerely,

Dr. Tim Trimble
Chair
School of Psychology Research Ethics Committee

7* February 2012

F.A.O. Brendan Cullen

School of Psychology Research Ethics Committee

Dear Brendan,

I am pleased to inform you that your application entitled "Laugh in the Lab" has been approved by the School of Psychology Research Ethics Committee.

Yours sincerely,

Dr. Tim Trimble
Chair
School of Psychology Research Ethics Committee