# EFFECTS OF ATTRACTIVENESS, DELAY, AND DISTINCTIVENESS ON FACE RECOGNITION

A thesis presented in partial fulfilment of the requirements for the degree of

Master of Arts
in
Psychology

at Massey University, Palmerston North

Jennifer J. Barbour

1999

# ABSTRACT

This study investigated the effects of attractiveness and delay on facial recognition. Distinctiveness was also examined in a second experiment. It was hypothesised that faces that were rated highly attractive or unattractive would be more memorable over time. Furthermore, a positive relationship between attractiveness and distinctiveness was expected.

In Experiment 1, 25 males and 25 females rated the facial attractiveness of 78 standardised photographs. These ratings were used to select three sets of 20 target faces for a standard facial recognition task, each set representing a different level of attractiveness: high, medium, and low. The recognition test was administered either 10 min or 28 days after the study phase, participants being randomly assigned to each combination of delay and attractiveness in 2 (Delay) x 3 (Attractiveness) between-groups design. There were main effects for both attractiveness and delay on recognition accuracy but the expected interaction between these two variables did not eventuate.

Experiment 2 was conducted to examine the relationship between attractiveness and distinctiveness ratings. A further 25 males and 25 females rated the facial distinctiveness of the 78 photographs used in Experiment 1. A strong curvilinear relationship was shown to exist between attractiveness and distinctiveness with the least attractive faces being rated the most distinctive and the moderately attractive faces the least distinctive. On the basis of the present results taken in conjunction with previous findings, it was concluded that facial distinctiveness is a major variable in face recognition studies.

# ACKNOWLEDGEMENTS

I would first like to thank my thesis supervisor, Dr. John Podd, for being generous with his time, providing a great deal of helpful discussion, and proof-reading earlier drafts of this thesis.

I would also like to thank Dr. John Spicer, Dr. Ross Flett, and Nick Kazantzis for their help with several statistical issues. I also appreciate the efforts of various members of the School of Psychology Workshop who helped arrange and prepare for experimental sessions.

A special thanks also goes to Jacinda Dalziell for voluntarily giving up her time to help with experimental preparation and data processing. Similarly, appreciation goes to Ian Barbour and Geordie McCallum for proof-reading earlier drafts.

This research was carried out with the support of the Massey University Graduate Research Fund and the School of Psychology.

# TABLE OF CONTENTS

# LIST OF TABLES

# LIST OF FIGURES

# INTRODUCTION

## OVERVIEW

The present study set out to investigate the effects of facial attractiveness and delay on face recognition, being a partial replication of an earlier study by Shepherd and Ellis (1973). Shepherd and Ellis investigated the effect of facial attractiveness on recognition memory for faces after retention intervals (delays) of zero, 6 days, and 35 days. An interaction between the physical attractiveness of a face and the delay between the study and recognition test phases was discovered. Specifically, there was a significant decline in recognition scores for faces of moderate attractiveness at the 35-day test, but not for faces of high or low attractiveness. High and low levels of attractiveness were suggested to have this effect because these faces had more distinctive features, and were therefore better remembered. Shepherd and Ellis argued that it is the distinctiveness of the high and low attractive faces that makes them more memorable than medium attractive faces.

The present study aimed to test this hypothesis firstly by attempting to replicate the Shepherd and Ellis (1973) study and then by experimentally examining their hypothesised relationship between facial attractiveness and distinctiveness. Should such a relationship be found, it could then be argued that the level of facial attractiveness is simply one way of varying facial distinctiveness and that the latter may be a more fundamental feature of a face.

## PROLOGUE

The human face is quite possibly the most important visual stimulus available to us. Ellis (1981) comments that in addition to helping create identity, the human face, "through its paramount role in communication, [it] commands our almost continuous attention" (p.1). An important role of the face as a visual stimulus is the provision of various meaningful types of social information (Young & Bruce, 1991). For example, recognising people we know, determining age and gender, deducing moods and feelings, regulating social interaction through eye contact and facial gestures, assisting in speech comprehension, and attributing characteristics on the basis of stereotypes (Young & Bruce, 1991). As social animals, this ability is extremely important if we are to interact and communicate effectively with others.

Flin and Dziurawiec (1989) comment that face processing appears to be "one of the most sophisticated and precocious skills of the young child's cognitive repertoire" (p.335). Yet, the development of face encoding skills from infancy through childhood to adolescence does not occur smoothly; for instance, face recognition at age 10 appears more stable and robust than at age 16 (Carey, 1981).

Development of face encoding skills throughout the first year of life is characterised by both visual maturity and increased experience with faces (Ellis, 1992). In general, infant vision appears to be very limited in regard to face recognition qualities. For example, Johnson and Morton (1991) found that at the age of 1 month, infants seem to discern only the grossest features of the face. Namely, a vague outline of the face with darker areas around the eyes and mouth. At the age of 2 months the 'externality effect' is observed where infants begin to focus on the boundaries of the face.

Development of facial recognition continues to advance and around the age of 4 months the infant can now clearly distinguish the proper arrangement of facial features (Carey, 1981). Additionally, the infant can recognise and distinguish between their mother and strangers. It has been suggested that these innate face-processing abilities serve a special role in mother-infant relationships (Studdert-Kennedy, 1983, cited Young, 1987).

While there has been extensive research on the development of face processing, there are few data on facial recognition in infancy (de Boysson-Bardies, de Schonen, Jusczyk, MacNeilage, & Morton, 1993). However, Pascalis, de Hann, Nelson, and de Schonen (1998) examined long-term recognition memory for faces in infants, assessed by visual paired comparison. Findings suggest the existence of long-term recognition memory in infants at just 3 months of age.

Although comprehensive research has been conducted on face memory in infancy and adulthood, few studies have examined the developmental changes in childhood and adolescence (Carey, 1981; Flin & Dziurawiec, 1989). However, more recent studies have identified some important changes.

Standard recognition memory paradigms have been adapted for studying face perception in childhood (Carey, 1981). It has been shown that while infancy is characterised by the rapid development of face encoding skills, childhood is distinguished by a steady improvement in performance (e.g., Carey, Diamond, & Woods, 1980; Flin, 1980). Specifically, children up to the age of 8 years tend to be poor at encoding unfamiliar faces. However, by 10 years of age most children verge upon, if not reach, normal adult level (Carey, 1981).

Adolescence is characterised by periods of instability, in contrast to the stable improvement in face encoding skills experienced in both infancy and childhood. After the age of 10, most children experience a brief period of disruption followed by further growth in face recognition ability until an adult level of face encoding skills is reached by about age 16 (Carey, 1981). Carey proposes that this small disruption suggests some kinds of "reorganisation of encoding processes during these years" (p.26). Thus, by about the age of 16 an adolescent has developed most of the remarkable face recognition skills that can be seen in the normal adults.

## BRIEF HISTORY OF FACE RECOGNITION RESEARCH

The field of face recognition research is one aspect of the cognitive approach to face processing, which studies how we perceive and remember faces. Historically, research on face perception and recognition has received only irregular and periodic attention from researchers. The first notable work on face recognition was produced in 1753 by William Hogarth when he wrote 'The

Analysis of Beauty', suggesting that "the face is the index of the mind" (Hogarth, 1753/1955, p.136). However, while this generated some interest, another century passed before the face was again the subject of serious investigation.

During this next period, face research was conducted by such renowned scholars as Darwin (1872) and Galton (1883) who discussed emotion and human development in regards to facial recognition. For example, in 1907 Galton hypothesised that faces that are more similar to each other are consequently more attractive (Galton, 1907). Furthermore, Darwin's study into the expression of the emotions of man and animals became the basis for an immediate best seller (Darwin, 1872). Remarkably, this text still provides a basis for research into emotion and facial expression today.

After this brief resurgence, another 100 years passed with the area of facial recognition characterised by infrequent and unsystematic research. It was not until the late 20th century that the area was thoroughly researched with over 600 papers on facial recognition published throughout the 1970's (Ellis, 1981). This rate of publication has continued over the last two decades. Consequently, there is now a vast amount of information available on face recognition.

## MEMORY FOR FACES

How accurately can we recognise large numbers of human faces after one short exposure? Carey (1981) proposes, perhaps simplistically, that our ability to recognise faces involves two aspects: encoding an unfamiliar face, and subsequently recognising that face. Thus, this process, recognition memory, involves the "identification of some previously experienced configuration or event" (Ellis, 1975, p.409). Several factors have been found to influence face recognition performance. These include the importance of different facial features, the amount of change in facial appearance, and context similarity (Bruce, 1988; Laughery & Wogalter, 1989).

Increasing interest in the processes underlying face recognition has contributed to substantial research over the last two decades (Young & Ellis, 1989). It is thought that face recognition involves unique processing mechanisms (Young, 1987). Thus, Young proposes that the ability to discriminate and recognise faces represents a remarkable human ability. This finding, that face recognition is an extraordinary process, has at least three sources. Firstly, inverted (upside-down) faces have been found to effect recognisabilty because of a combination of unfamiliarity with upside down stimuli and a special factor related only to faces (Yin, 1969). Next, studies of cerebral hemisphere differences show that the right cerebral hemisphere is instrumental to face recognition (Hecaen & Angelergues, 1962; De Renzi & Spinnler, 1966; Warrington & James, 1967). Finally, patients with brain injuries have been found unable to recognise familiar faces (prosopagnosia) (Ellis, 1975; Young, 1987), illustrating the crucial effect of bilateral cerebral hemisphere injuries on face recognition.

Recognition memory for heterogeneous pictorial material suggests that humans have the capacity to store and retrieve a very large amount of material (Goldstein & Chance, 1970). Studies have shown that faces tend to be remembered more easily than other homogeneous pictorial material, such as snowflakes and fingerprints, even though we can discriminate between the latter (Harmon, 1973). For example, Goldstein and Chance investigated visual recognition memory for complex configurations and found that faces had the highest recognition accuracy rate when compared to ink blots and snow crystals. Other authors have found support for this view (see Ellis, 1975, for a review; Johnson & Morton, 1991).

In summary, in recent decades memory for the human face has been intensively investigated. One of the major investigative paradigms has been, and still is, the recognition memory test. Participants are presented with a number of faces to study (study phase) and later, after some period of delay, are asked to identify the 'target' faces when randomly intermixed with a number of 'distractor' faces (test phase). In the following sections, this recognition memory model is briefly described, followed by a discussion of two key variables that have been the subject of much investigation in recent years: facial attractiveness and the retention interval (period of delay) between the study and test phase.

## TYPICAL RECOGNITION STUDY

The recognition memory model is based on Signal Detection Theory (SDT) and involves presenting participants with a number of photographs of faces, usually in the form of slides shown sequentially. The photographs usually have been black and white, and show only a full-frontal view of the face. Firstly, a study phase is conducted involving presentation of the slides. Generally, participants are informed that they should pay close attention to the faces (targets), as they will be requested to attempt to recognise them at a later time. However, Courtois and Mueller (1981) found that it made little difference to the results whether or not participants were told that a recognition test would follow.

Next, the recognition phase (test phase) is conducted which can take place either immediately or after some period of delay. The participants are shown the target faces again, this time randomly interspersed with other faces (distractors) which they have not seen before. Participants are asked to indicate which of the faces they think they have seen before, by rating them as either old (previously seen) or new (not previously seen), sometimes giving the level of confidence in their decision as well. Laughery, Fessler, Lenorovitz, and Yoblick (1974) used just one target and 149 distractors in their recognition test. However, more commonly, a ratio of between 1:2 and 1:4 is used. Shapiro and Penrod (1986), in their meta-analysis of facial identification studies, found a mean of 22 targets shown at study and test phases, with a mean of 40 distractors in the recognition test.

The faces used are either of males only, or of males and females; seldom are only female faces used. The most likely reason for this is that much of the face recognition literature has been related to crime research, with the vast majority of criminals being males. Most studies have used only white (Caucasian) faces. The length of delay between study and test phases varies greatly, with many studies using several different retention intervals for comparison, as well as an immediate test (zero delay) as a control. Deffenbacher (1986) reported a "vast range" of retention intervals tested in the literature on laboratory studies of face recognition, from "one minute to 350 days" (p.63). Shapiro and Penrod (1986) found a mean delay of 4.5 days, with a standard deviation of 21 days.

The key variable for memory of a face is memory strength. When participants in a typical recognition study are presented with a face they must decide whether the face is 'old' (previously seen) or 'new' (not previously seen). They set a cut-off (criterion) on the memory strength decision axis. If memory strength is above this point, the decision is 'old'; otherwise the decision is 'new'. Participants are thought to be incapable of making their judgements with certainty. That is, there is some overlap between the distribution of old and new faces. Because of the confusability between old and new faces, there are four decision outcomes possible: (a) *Hit.* Decide 'old' when the face was in fact old; (b) *False Alarm.* Decide 'old' when the face was in fact new; (c) *Correct Rejection.* Decide 'new' when the face was in fact new; (d) *Miss.* Decide 'new' when the face was in fact old.

The distance between the means of the old and new distribution indexes the ability of the participant to recognise a face. The usual recognisabilty index is $d'$, defined as $X_o - X_N / SD_N$, where $X_o$ is the mean of the old distribution, $X_N$ is the mean of the new distribution, and $SD_N$, the standard deviation of the new distribution. An equivalent non-parametric recognisabilty index is A', defined as $0.5 + [(H - F)(1 + H - F)] / [4H (1 - F)]$, where H is the hit rate, and F is the false alarm rate. The strength of SDT is that the participant's recognisiability index is free from the effects of response bias, measured at the point at which a participant sets a cut-off point on the decision axis. There are several estimates of bias; the one used in the present study is $c$, defined as $-0.5 [z(H) + z(F)]$, where $z(H)$ and $z(F)$ are the $z$-score hit and false alarm rates, respectively (Macmillan & Creelman, 1991).

Two key variables that have been investigated in the present study using the SDT paradigm are retention interval (delay) and facial attractiveness.

## DELAY

The retention intervals used in face recognition studies have ranged from a few seconds (e.g., Walker-Smith, 1978) to a study-test interval of 57 years as used by Bahrick, Bahrick, and Wittlinger (1975). Studies such as the latter are extremely rare, due to the obvious difficulties that the great length of time involves. The study by Bahrick et al. is often cited to show the phenomenal durability of memory for familiar faces over very long time periods.

The variable of delay, or time span between study and test phases, has generated much interest in facial recognition studies. This research has been characterised by relatively short periods of delay, usually not greater than 5 weeks (Podd, 1990). Possibly because of the small effect sizes produced by these shorter delay periods, the effects of delay on facial recognition have been rather mixed.

***Research Findings***

Several studies have shown that delay has little or no effect on facial recognition performance. For example, Goldstein and Chance's (1970) study on visual recognition memory for complex configurations used a 48-hr delay between study and recognition phases and found no effect of delay for faces. Similarly, Yarmey (1971) and Laughery et al. (1974), using a 20-min and 1-week retention interval, respectively, also discovered that delay had little or no effect on accuracy.

Delay was also found to have little effect in a study conducted by Deffenbacher, Carr, and Leu (1981). They found that recognition accuracy for both words and pictures declined with a delay of 2 weeks, but facial recognition rates remained constant. More recently, Chance and Goldstein (1987) reinvestigated their previous study reported in 1970 on retention interval and face recognition with a delay of 2 or 7 days. As found previously, retention interval appeared to have no effect on accuracy. However, false alarms increased with longer delay, a frequent finding (Egan, Pittner, & Goldstein, 1977; Podd, 1990)

While several investigations find no delay effects on recognition accuracy, an equal number have suggested that the retention interval can significantly affect recognition performance. For instance, Krouse (1981) investigated the effects of pose, pose change, and delay on recognition performance. Retention intervals of 2 to 3 days revealed statistically significant effects for both pose and pose change. Similarly, Courtois and Mueller (1981) examined target and distractor typicality with delays between study and recognition phases of 2 or 28 days. Results indicated that delay had a statistically significant effect on recognition performance for both time delays.

Barkowitz and Brigham (1982) studied recognition of faces in regard to own-race bias, incentive, and time delay, using a 2- or 7-day delay. Recognition accuracy of male faces was found to decrease after the longer time delays, but there was no such statistically significant effect for female faces. Furthermore, Shepherd, Gibling, and Ellis (1991), investigating the effects of distinctiveness, presentation time, and delay on face recognition with delay periods of 1 day or 1 month, found a statistically significant effect for delay with faces previously judged highly distinctive.

The mixed findings of a delay effect suggest that, at least for relatively short delays of up to 5 weeks, the effect sizes obtained are quite small. Combining results across several studies in a meta-analysis should result in a clearer picture. Shapiro and Penrod (1986) conducted an extensive meta-analysis on facial identification studies, combining results from 190 studies involving some

16,950 participants. Among other findings, retention interval was found to have a strong effect on recognition performance.

In summary, the effects of delay in the accuracy of facial recognition have produced conflicting results from individual studies, although the meta-analysis work of Shapiro and Penrod (1986) make it very clear that delay does in fact affect recognition accuracy. Any effects of relatively short delays are likely to be small due to the extraordinary ability humans have for remembering faces. Furthermore, many factors may act to moderate the effects of delay, one of these being facial attractiveness.

## FACIAL ATTRACTIVENESS

Human faces have been found to provoke an affective response in the viewer. In relation to facial recognition, one affective aspect of faces is their rated attractiveness (Davies et al., 1981). Brown (1993) defines attractiveness as having the "property of attracting interest, attention, affection, desire...pleasing, alluring" (p.145). Furthermore, evaluation of attractive faces tends to be consistent across gender, age, social class, and ethnic group (Davies et al., 1981; Iliffe, 1960). Davies et al. believe that media such as cinema, television, and cosmetic advertising may help to account for these attractiveness stereotypes.

However, some research has demonstrated the exact opposite of this position. For example, Darwin (1872/1952) conducted a survey on beauty standards of various tribes and societies and concluded, " it is certainly not true that there is in the mind of any man any universal standard of beauty with respect to the human body" (p.577). Additionally, Cross and Cross (1971) examined how social factors may influence the perception of facial beauty and concluded that ratings of facial attractiveness were not affected by age, but instead by gender and race, and interactions between the two.

### *Research Findings*

Langlois, Roggman, and Rieser-Danner (1990) explored infants' social responses to highly attractive and unattractive faces. Their results replicated previous findings in showing that young infants demonstrate visual preferences for attractive over unattractive faces, as rated by independent judges. Similarly, Samuels, Butterworth, Roberts, & Graupner (1994) investigated visual preferences of infants for faces that varied in facial attractiveness and symmetry about the midline. They were attempting to establish whether visual preferences for attractive faces were effected by the vertical symmetry of the face. Their results suggest that infants as young as 4 months demonstrate a similar perception of attractiveness as adults.

Research into the effects of attractiveness and memory began in the early $20^{th}$ century when Peters (1917) examined the relationship between the 'pleasantness' of faces and their memorability, and proposed that the more extreme a face was rated in attractiveness or unattractiveness, the more easily it was later recognised. It was not until the early 1970's that further research was conducted on facial attractiveness. However, as for the effect of delay on face recognition, studies on facial attractiveness and memorability have been remarkably inconsistent.

Firstly, Cross, Cross, and Daly (1971) examined, among other things, the role of beauty as a factor in facial recognition. Findings suggested greater memorability for faces previously judged attractive. However, Fleishman, Buckley, Klosinsky, Smith, and Tuck (1976), investigating judged attractiveness in recognition memory of women's faces, found that faces judged most and least attractive were the more easily recognised. The authors concluded that both high and low levels of attractiveness are important moderators of facial recognition (c.f., Peters, 1917).

Another variation of results was reported by Light, Hollander, and Kayra-Stuart (1981) who found that faces judged highly attractive were harder to recognise. They suggest that the reason for this outcome is that highly attractive faces are more 'typical' in appearance. In other words, as facial attractiveness increases, recognisabilty decreases.

Similarly, Langlois and Roggman (1990) examined the notion that faces rated average, or typical, in appearance would be "consistently judged as attractive" (p.115). Findings indicated that that averaged faces from computer composites were found to be more attractive than the original faces from which they were derived. But Yarmey (1979), investigating the effects of facial attractiveness, feature saliency, and liking on facial recognition, concluded that recognition performance declines over time with the faces of attractive females and unattractive males causing the least decline.

Finally, Gehring, Toglia, and Kimble (1976) investigated the effects of attractiveness on the recognition of women's faces. Faces judged most and least attractive produced better recognition rates than faces judged neutral or average. The authors discussed arousal and distinctiveness cues as possible explanations.

In contrast, several studies have found no relationship between facial attractiveness and memorability. For example, Cutler and Penrod (1989) considered possible moderators of the confidence-accuracy correlation in facial recognition. They found a statistically significant positive correlation between facial attractiveness and distinctiveness. However, no statistically significant effects were found for facial attractiveness on facial recognition performance. Similarly, Brigham (1990), investigating target person distinctiveness and attractiveness as moderator variables in the confidence-accuracy relationship in eyewitness identification, found no relationship between facial attractiveness and facial recognition accuracy.

To summarise, as for the effects of delay, the effect of facial attractiveness on face recognition has produced mixed findings, an outcome that has yet to be satisfactorily explained. However, a number of these studies have suggested that attractiveness may be related to facial distinctiveness. One important investigation that suggests that facial attractiveness effects may be explained in terms of distinctiveness is that of Shepherd and Ellis (1973).

Shepherd and Ellis (1973) investigated the effect of attractiveness on recognition memory for faces. Ninety-seven slides of female faces were first rated for facial attractiveness on a 9-point scale, ranging from 'most good-looking' to 'least good-looking'. Three levels of attractiveness were selected: low, medium, and high. Next, the recognition study was conducted with 3 delay periods: immediate (zero delay), 6 days, and 35 days.

Eighteen males and 18 females were shown 27 slides and asked to memorise them, as they would be shown some of the slides again and asked to recognise them. As this was a repeated-measures design, with the same participants used for each of the three delay intervals, a different third of the target set was shown at each test. The recognition test used a two-alternative, forced-choice (2AFC) presentation mode, with participants asked to indicate which of two simultaneously presented faces they had previously seen.

Results were analysed using a 2 (Gender) x 3 (Attractiveness level) x 3 (Delay) within-subjects analysis of variance (ANOVA). Statistically significant results were obtained not only for the hypothesised interaction between attractiveness and delay, but also for the main effect of delay. The number of faces correctly recognised (out of nine, chance = 4.5) declined from 8.05 (immediate test) to

7.28 (6 days) to 6.42 (35 days). One interpretation that Shepherd and Ellis (1973) offer for the observed interaction is that faces high or low in facial attractiveness may be more 'distinctive' than neutral faces, making them more memorable.

There are a number of weaknesses in the Shepherd and Ellis (1973) study, not the least of which is that a totally within-subjects design was used. Although each of the three groups of participants saw different sets of faces at the three delays, it is likely that faces previously seen interfered with facial recognition. Another weakness was that the number of target faces (nine) was very small. Such a small number of faces may have resulted in ceiling effects that may have affected the results.

The aim of the first experiment reported in the present study was to attempt a replication of the Shepherd and Ellis (1973) investigation using a 1AFC presentation mode (one face presented at a time) rather than a 2AFC presentation mode, and where delay was treated as a between-groups factor. That is, a different set of participants was used for each delay period to ensure that interference among different sets of facial stimuli was not possible.

# EXPERIMENT 1

## ATTRACTIVENESS RATINGS

There was not a suitable set of faces available that was scaled for facial attractiveness. Therefore, a scaling exercise was undertaken to obtain ratings of facial attractiveness for a set of 78 slides from which a subset of faces was to be selected for the main study on facial recognition.

### METHOD

#### *Participants*[1]

A total of 50 volunteers (25 male and 25 female, age range 18 to 27 years, *M* = 22.08, *SD* = 2.41) who were Massey University undergraduate and graduate students served as participants. Participants were excluded from the study if they recognised any of the stimulus faces.

#### *Materials & Design*

A stimulus pool of 78 colour slides was prepared[2]. The slides were half-frame, 35-mm Ektachrome transparencies showing a head and shoulder view of a Caucasian male with no outstanding facial features, such as scars, port-wine stains, and so on. Photographs were taken from volunteers aged mainly in their late teens and early twenties. The sample consisted primarily of Massey

[1] The Massey University Human Ethics Committee approved procedures for all stages in this thesis.
[2] These slides were originally prepared for several earlier face recognition studies, but had not been scaled for facial attractiveness.

University students with the remaining few being construction workers and police officers. Those wearing glasses or earrings were asked to remove them for the photograph.

The original photographs were taken under standardised lighting conditions against a neutral cream background. In order to eliminate cues from clothing, the subjects were required to wear a dark blue cape around their shoulders (c.f., Thornton, 1939). Participants were required to adopt a relaxed pose with a neutral expression while having their photograph taken.

Each of the 78 slides was assigned a random number from 1 to 78 for identification purposes throughout the study.

***Apparatus***

For the ratings of facial attractiveness the slides were projected using a Kodak Carousel S-RA projector with a 9-13 cm, F3.5 Zoom Ektamar lens, onto a 1.5 m x 1.5 m smooth white screen. An Apple IIe microcomputer served as a timer to control the presentation of slides by providing a 5-s exposure time per slide and a 2-s inter-slide interval. Each face was presented approximately 2 times life-size.

The screen was located in the front centre of the room at a height slightly above the heads of the seated participants. Participants sat in three rows of four, three, and three, respectively. Viewing distance varied (according to seating position) between 2 m and 4 m. The projector was located at the rear centre of the room, and the projected light extended across the centre of the three rows of participants onto the screen. The room was darkened to ensure good vision of the slides but with sufficient light for participants to read and mark their response sheets.

### *Procedure*

Participants rated each face independently for level of facial attractiveness. Clear verbal instructions were given prior to testing (see Appendix A for the verbatim instructions). Groups of 10 participants were asked to view the slides and rate each face for facial attractiveness on a 9-point scale ranging from *very unattractive* to *very attractive*. Clear indications of these scale anchor points were provided at both the top and bottom of each side of the response sheet (see Appendix A).

Participants were informed that ratings should be made after each slide was presented, during the 2-s rating interval. A short break of approximately 30-s was provided at the end of 40 trials to allow a brief rest, time to turn the page over on their response sheet, and a chance to ensure that all items had been completed.

At the conclusion of the session, participants were asked if they had recognised any of the stimulus faces. If a participant was acquainted with the photographed person, it was assumed that this might bias the attractiveness rating of that person (see Cavior, 1970, cited Berscheid & Walster, 1974). Any such participant's response sheet was to be discreetly marked and later removed from the analysis. Reasons for the importance of non-acquaintance with stimulus participants were given at the conclusion of the session. However, none of the participants were acquainted with any of the people portrayed in the slides.

## RESULTS

Results for all stages of the present research programme were computed using SPSS/PC+ for Windows, Version 9.0 (SPSS, 1999). The means (*M*) and standard deviations (*SD*) for each slide were computed separately for males and females (see Appendix B). After checking that the standard deviations of the ratings were relatively homogenous, Pearson's $r$ was calculated for male and female ratings and a coefficient of $r = 0.95$ was obtained. Consequently, since there was a very strong agreement between male and females for the attractiveness ratings, results were collapsed across gender, as shown in Table1.

The attractiveness ratings ranged from 1.96 to 5.90 ($M = 3.68$, $SD = 1.33$) on a 9-point scale. As can be seen in Table 1, all of the standard deviations of the ratings fell between 0.90 and 1.70 with the great majority falling between 1.00 and 1.50. This indicates that the variability across participants for the face stimuli was relatively homogeneous.

Table 1

*Attractiveness ratings means (M) and standard deviations (SD) for each of the 78 stimulus photographs for males and females combined.*

| SN | *M* | *SD* | SN | *M* | *SD* |
|---|---|---|---|---|---|
| 1 | 3.82 | 1.30 | 41 | 4.52 | 1.52 |
| 2 | 4.02 | 1.30 | 42 | 5.12 | 1.30 |
| 3 | 2.74 | 1.09 | 43 | 3.50 | 1.15 |
| 4 | 5.34 | 1.40 | 44 | 3.50 | 1.45 |
| 5 | 3.70 | 1.15 | 45 | 3.24 | 1.08 |
| 6 | 2.86 | 1.39 | 46 | 4.36 | 1.70 |
| 7 | 1.96 | 0.90 | 47 | 4.22 | 1.43 |
| 8 | 1.98 | 1.15 | 48 | 3.22 | 1.15 |
| 9 | 4.02 | 1.32 | 49 | 5.76 | 1.59 |
| 10 | 5.90 | 1.33 | 50 | 3.54 | 1.27 |
| 11 | 4.70 | 1.09 | 51 | 3.38 | 1.19 |
| 12 | 3.86 | 1.18 | 52 | 2.54 | 1.05 |
| 13 | 3.62 | 1.14 | 53 | 2.08 | 1.28 |
| 14 | 2.82 | 1.30 | 54 | 2.76 | 1.47 |
| 15 | 3.32 | 1.50 | 55 | 3.06 | 1.22 |
| 16 | 3.74 | 1.40 | 56 | 3.38 | 1.28 |
| 17 | 4.04 | 1.31 | 57 | 5.60 | 1.37 |
| 18 | 2.94 | 1.26 | 58 | 4.90 | 1.40 |
| 19 | 3.16 | 1.46 | 59 | 3.64 | 1.06 |
| 20 | 5.40 | 1.41 | 60 | 3.90 | 1.33 |
| 21 | 3.06 | 1.52 | 61 | 3.66 | 1.33 |
| 22 | 4.18 | 1.37 | 62 | 3.84 | 1.49 |
| 23 | 4.10 | 1.40 | 63 | 3.68 | 1.54 |
| 24 | 3.04 | 1.12 | 64 | 3.82 | 1.29 |
| 25 | 2.64 | 1.16 | 65 | 3.40 | 1.33 |
| 26 | 2.56 | 1.30 | 66 | 2.86 | 1.07 |
| 27 | 3.88 | 1.32 | 67 | 3.50 | 1.56 |
| 28 | 3.24 | 1.62 | 68 | 2.82 | 1.50 |
| 29 | 3.18 | 1.40 | 69 | 3.36 | 1.31 |
| 30 | 3.12 | 1.15 | 70 | 4.04 | 1.55 |
| 31 | 4.60 | 1.41 | 71 | 3.90 | 1.34 |
| 32 | 4.08 | 1.26 | 72 | 4.14 | 1.65 |
| 33 | 4.32 | 1.50 | 73 | 3.14 | 1.09 |
| 34 | 3.70 | 1.18 | 74 | 3.42 | 1.30 |
| 35 | 3.76 | 1.22 | 75 | 2.94 | 1.33 |
| 36 | 2.86 | 1.27 | 76 | 5.12 | 1.51 |
| 37 | 3.42 | 1.40 | 77 | 3.72 | 1.33 |
| 38 | 5.44 | 1.68 | 78 | 3.80 | 1.33 |
| 39 | 3.06 | 1.35 | | | |
| 40 | 3.46 | 1.37 | | | |

Note. SN = Slide number

Based upon these ratings, a smaller sample of 60 photographs that ranged across the whole attractiveness continuum was selected for use in the recognition memory study. Specifically, 20 slides from the bottom quartile of the distribution of ratings which ranged from 1.96 to 3.12 (*M* = 2.74, *SD* = 1.24) comprised the unattractive, or low, group; 20 slides from the semiquartile above and the semiquartile below the median of the ratings which ranged from 3.38 to 3.82 (*M* = 3.60, *SD* = 1.30) comprised the average attractiveness, or medium, group; and 20 slides from the top quartile which ranged from 4.04 to 5.90 (*M* =4.79, *SD* = 1.43) comprised the attractive, or high, group. Thus, the 60 slides were divided into three groups representing low, medium, and high levels of attractiveness.

The 60 chosen photographs were renumbered from 1 to 60 with 1 equating to the lowest ranking photograph (most unattractive) and 60 equating to the highest ranking photograph (most attractive).

## FACIAL RECOGNITION STUDY

The subset of 60 slides of low, medium, and high attractiveness faces were used to investigated the effect of facial attractiveness and delay on face recognition.

## METHOD

### *Participants*

A total of 60 volunteers (30 females and 30 males, age range 18 to 25 years, *M* = 20.79 years, *SD* = 1.74) who were Massey University undergraduates and graduates served as participants. None had participated in the attractiveness rating exercise. As before, participants were excluded from the study if they recognised any of the stimulus faces. Participants were randomly assigned to the 6 different conditions, with 9 or 10 participants and a similar sex ratio in each group.

### *Design*

The experimental design is illustrated in Figure 1. The number of participants is shown for each combination of the two factors. The design of the experiment was a 2 x 3 factorial design in which the between-subjects factors were time delay (10 min or 28 days) and facial attractiveness (high, medium, or low). Twenty target faces were presented to the participants for a presentation time of 5 s. The participants were then required to recognise the 20 target faces randomly mixed with 20 distractors after a delay of either 10 min or 28 days. The 20 target slides comprised one of the high, medium, or low facial attractiveness groups. The distractors were randomly selected from the remaining 58 slides. The same set of distractor faces was used for all combinations of attractiveness and delay.

| Attractiveness Levels | | Time Delay | |
|---|---|---|---|
| | | 10 min | 28 days |
| | High | 10 | 9 |
| | Medium | 10 | 9 |
| | Low | 10 | 10 |

Figure 1

*Experimental design. Both Attractiveness and Delay were between-subjects factors. The number of participants for each combination of the two factors is also shown.*

### *Apparatus*

As for the attractiveness ratings, slides were shown using a Kodak Carousel S-RA projector and a 1.5 m x 1.5 m white screen with a 5-s exposure time per slide and a 2-s decision interval. Room set-up and conditions were identical to those used for the attractiveness ratings.

### *Procedure*

Participants took part in two slide presentations in order to test facial recognition. All 6 groups of 9 or 10 participants were firstly asked to engage in the study phase.

*Study Phase*

The study phase was the same for all participants. Groups of 9 or 10 participants (all those within a group being from the same condition) were shown the target set of 20 faces in a consecutive random order which remained constant for all participants across all conditions. Clear verbal instructions were read to participants, making it explicit that they were simply required to observe the slides. However, it was pointed out that they would be required to recognise the slides in a second slide presentation, so they were asked to be attentive to each slide (see Appendix C for the verbatim instructions).

After presenting the target set, participants were then questioned as to whether they knew any of the people in the slides. Participants in the 10-min delay were asked to sit quietly for 10 min until the test phase was commenced. Participants in the 28-day delay were thanked for attending and asked to remember to return for the recognition phase 28 days later.

*Test Phase*

The test phase differed for participants according to experimental condition. For those in the 10-min delay condition this took place 10 min after the conclusion of the study phase. During the 10-min delay participants were asked to sit quietly and refrain from discussing the faces just seen in the slide presentation. Those participants in the 28-day delay conditions were asked to return after the required delay period.

The test phase began with verbal instructions read to participants reminding them that they would be attempting to recognise slides seen in the study phase. Participants were asked to mark 'yes' if they had seen that slide in the first phase and 'no' if the if they had not seen that slide before. Finally, participants were asked to respond to every slide even if they were unsure (see Appendix C for the instructions). Each participant was given a response sheet consisting of one double-sided page with one 20-space column on each side. These spaces were numbered consecutively from 1 to 40. Each space on the response sheet corresponded to one of the test series slides. After viewing a slide, participants marked either 'yes' (face previously seen) or 'no' (face not previously seen) (see Appendix C). Once again, a 5-s exposure time per slide and a 2-s decision interval were used. The procedure was identical for each of the 6 groups.

### *Recognition Measures*

Signal Detection Theory (SDT) measures were used to assess face recognition performance. Five SDT measures were used to assess various aspects of performance: hits, false alarms, *d'*, *A'*, and *c*.

(1) *Hits*. The proportion of old responses for faces previously seen.

(2) *False alarms*. The proportion of old responses for faces not previously seen.

(3) *d'*. The SDT recognition accuracy index. This is a parametric statistic, assuming underlying old and new distributions that are normally distributed with equal variance.

(4) *A'*. In order to check the validity of *d'*, a non-parametric estimate of recognition accuracy was also estimated. The index is a measure of the area under the ROC curve based on one pair of hit and false alarm rates (e.g., see McNicol, 1972).

(5) *Criterion (c)*. An estimate of each participant's criterion was also made. This estimate gives an indication of the degree of response bias (willingness to report a face as previously seen) that is independent of the recognition accuracy index, *d'*.

Each of the above measures was subjected to a separate 2-way ANOVA. The alpha level for all statistical tests was set at .05. Effect sizes (*ES*) are also reported and were calculated according to the recommendations of Cohen (1988).

## RESULTS & DISCUSSION

Analyses were conducted to determine whether level of attractiveness (ATTRACT) and time delay (DELAY) affect facial recognition. The responses from the recognition task ('yes' or 'no') were converted to hit and false alarm values. These values were then used to calculate five measures: proportion of hits, proportion of false alarms, *d'*, *A'*, and *c*.

### *Hits*

There was a decrease in mean hits from 10 min to 28 days for all three levels of attractiveness. The greatest effect by far occurred for the high attractiveness levels (12% drop in hit rate). The medium and low-level groups' hit rates decreased only 3% and 1%, respectively. The means and standard deviations for the hit rates are shown in Table 2.

Table 2

*Means (M) and standard deviations (SD) for hits*

| Group | Delay | *M* | *SD* |
|---|---|---|---|
| High[a] | 10 min | .81 | 0.11 |
| | 28 days | .69 | 0.12 |
| | Total | .76 | 0.12 |
| Medium[b] | 10 min | .71 | 0.11 |
| | 28 days | .68 | 0.21 |
| | Total | .69 | 0.16 |
| Low[c] | 10 min | .80 | 0.10 |
| | 28 days | .79 | 0.09 |
| | Total | .79 | 0.09 |
| Total | 10 min | .77 | 0.12 |
| | 28 days | .72 | 0.15 |
| | Total | .75 | 0.13 |

[a] High level of facial attractiveness. [b] Medium level of facial attractiveness. [c] Low level of facial attractiveness.

As shown in Table 3, attractiveness level was found to have a statistically significant effect on hit rate, $F(2,52) = 3.12$, $p = .05$, $ES = 0.35$. There was no significant effect for delay, $F(1,52) = 2.17$, $p = .15$, $ES = 0.20$, and the attractiveness by delay interaction was also not significant, $F(2,52) = 1.02$, $p = 0.37$, $ES = 0.20$, despite the fact that the largest mean change in hits by far occurred for the high attractive group. It can be noted that for both delay and the delay by attractiveness interaction the *ES* values (0.20) were very small.

Table 3

*ANOVA summary for hits*

| Source | *SS* | *df* | *MS* | *F* | Sig. | *ES* |
|---|---|---|---|---|---|---|
| ATTRACT | 0.10 | 2 | .05 | 3.12 | .05 | .35 |
| DELAY | 0.04 | 1 | .04 | 2.17 | .15 | .20 |
| ATTRACT*DELAY | 0.03 | 2 | .02 | 1.02 | .37 | .20 |
| Error | 0.84 | 52 | .02 | | | |
| Total | 1.01 | 58 | | | | |
| Corrected Total | 1.01 | 57 | | | | |

Paired comparisons for the three levels of attractiveness were tested for significance using *t*-tests for independent samples. It was found that the means for the high (0.76) and medium (0.19) faces, and high (0.76) and low (0.79) faces did not differ, while the difference between the medium (0.69) and low (0.79) groups was significant, $t\ (37) = 2.38$, $p < .05$. Thus the main contribution for the main effect for attractiveness for hits came from the difference between the medium and low attractiveness groups.

This finding, that faces of high and low attractiveness yield higher hit rates, may have resulted from the fact that these faces have outstanding features that make them more recognisable. For example, Sarno and Alley (1997) suggest that facial distinctiveness may result from both local (e.g., scars, skin blemishes) and global (e.g., unusual facial proportions) properties. Hence, faces of high and low attractiveness in the present study are likely to have marked distinctive differences from the faces of medium attractiveness.

An alternative explanation is that unusual faces (high and low attractiveness) are scanned more attentively and therefore better encoded in the first place. A major question for future research is how to find out whether recognition rates like these are affected by encoding, retrieval problems, or a combination of both.

### *False Alarms*

Mean false alarm values, given in Table 4, reveal that false alarm rates tend to increase over the longer time delay period. This effect can be clearly seen in the medium attractiveness level conditions, with there being a large 11% increase in false alarms with delay. There was a 3% and 5% increase in false alarms for the high and low attractiveness faces, respectively.

As suggested by Table 5, delay had a strong main effect on false alarm rate, $F(1,52) = 6.79$, $p = .01$, $ES = .36$. In fact, the *ES* for hits and false alarms were 0.35 and 0.36, respectively, suggesting that whereas attractiveness affected the hit rate, delay affected the false alarm rate. There was no main effect for attractiveness for false alarms, $F(2,52) = 1.91$, $p = .16$, $ES = 0.27$, although it can be noted that there was a small *ES* of 0.27, possibly suggesting that attractiveness does have some influence on false alarms. There was no interaction between attractiveness level and time delay $F(2,52) = 1.00$, $p = .37$, $ES = 0.20$, even though only the medium attractive faces made a substantial contribution in terms of a delay effect.

Table 4

*Means (M) and standard deviations (SD) for false alarms*

| Group | Delay | *M* | *SD* |
|---|---|---|---|
| High[a] | 10 min | .10 | 0.05 |
| | 28 days | .13 | 0.13 |
| | Total | .12 | 0.10 |
| Medium[b] | 10 min | .12 | 0.09 |
| | 28 days | .23 | 0.06 |
| | Total | .17 | 0.09 |
| Low[c] | 10 min | .10 | 0.08 |
| | 28 days | .15 | 0.14 |
| | Total | .13 | 0.12 |
| Total | 10 min | .11 | 0.07 |
| | 28 days | .17 | 0.12 |
| | Total | .14 | 0.10 |

[a] High level of facial attractiveness. [b] Medium level of facial attractiveness. [c] Low level of facial attractiveness.

The increased false alarm rate seen in the present results are consistent with previous findings (e.g., Egan, Pittner, & Goldstein, 1977; Podd, 1990). Podd suggests that delay may affect false alarm rates more than hit rates because the effect of delay is tantamount to increasing the similarity between targets and distractors, (which also increases false alarm rates). As the memory for a face decays, some of the features that would be used to decide whether a face was previously seen are lost. Thus, comparisons with stored memories are made with fewer features, thereby increasing the likelihood of a false alarm. While medium attractive faces yielded the lowest hit rate, they had the highest false alarm rate, suggesting that recognisability (*d'*) would be poorest for these faces.

Table 5

*ANOVA summary for false alarms*

| Source | *SS* | *df* | *MS* | *F* | Sig. | *ES* |
|---|---|---|---|---|---|---|
| ATTRACT | 0.04 | 2 | .02 | 1.91 | .16 | .27 |
| DELAY | 0.07 | 1 | .07 | 6.79 | .01 | .36 |
| ATTRACT*DELAY | 0.02 | 2 | .00 | 1.00 | .37 | .20 |
| Error | 0.50 | 52 | .00 | | | |
| Total | 0.63 | 58 | | | | |
| Corrected Total | 0.62 | 57 | | | | |

***Changes in Recognisability***

There is some danger in assessing recognition accuracy by examining hit and false alarm rates separately, for each alone can be influenced by both changes in recognition accuracy and response bias. The index that combines hits and false alarms is *d'*, a bias-free measure of recognition accuracy. Table 6, displays the means and standard deviations for *d'*.

As can be seen in Table 7, the attractiveness of the stimulus faces affected accuracy, with medium attractive faces producing a lower level of accuracy than the other two levels, $F(2,52) = 5.00$, $p = .01$, $ES = 0.44$. This main effect for attractiveness was mainly due to the medium attractive faces being harder to recognise, $M = 1.58$, than the high attractive faces, $M = 2.11$ [$t$ (36) = 3.71, $p < .05$], and the low attractive faces, $M = 2.21$ [$t$ (37) = 3.08, $p < .05$]. Thus, as suggested by the relatively lower hit rates and higher false alarm rates, medium attractive faces were the most difficult to recognise, while high and low attractive faces yielded very similar recognition rates. These results do not support the earlier findings of Light et al. (1981) who found that the most attractive faces were the most difficult to recognise.

Table 6

*Means (M) and standard deviations (SD) for d'*

| Group | Delay | *M* | *SD* |
|---|---|---|---|
| High[a] | 10 min | 2.29 | 0.58 |
| | 28 days | 1.91 | 0.78 |
| | Total | 2.11 | 0.69 |
| Medium[b] | 10 min | 1.86 | 0.51 |
| | 28 days | 1.27 | 0.75 |
| | Total | 1.58 | 0.69 |
| Low[c] | 10 min | 2.27 | 0.44 |
| | 28 days | 2.15 | 0.92 |
| | Total | 2.21 | 0.71 |
| Total | 10 min | 2.14 | 0.54 |
| | 28 days | 1.79 | 0.88 |
| | Total | 1.97 | 0.74 |

[a] High level of facial attractiveness. [b] Medium level of facial attractiveness. [c] Low level of facial attractiveness.

Table 7

*ANOVA summary for d'*

| Source | *SS* | *df* | *MS* | *F* | Sig. | *ES* |
|---|---|---|---|---|---|---|
| ATTRACT | 4.64 | 2 | 2.32 | 5.00 | .01 | 0.44 |
| DELAY | 1.88 | 1 | 1.88 | 4.06 | .05 | 0.28 |
| ATTRACT*DELAY | 0.54 | 2 | 0.27 | 0.58 | .58 | 0.15 |
| Error | 24.12 | 52 | 0.46 | | | |
| Total | 31.18 | 58 | | | | |
| Corrected Total | 30.96 | 57 | | | | |

A main effect for delay was also found to be statistically significant, $F(1,52) = 4.06$, $p = .05$, $ES = 0.28$, with at least a small effect for all attractiveness levels. However, the largest effect was for faces of medium attractiveness with a 0.59 mean difference between 10 min and 28 days. There was no significant effect for the interaction between attractiveness and delay, $F(2,52) = 0.58$, $p = .58$, $ES = 0.15$.

Hence, both attractiveness level and delay affected face recognition, but the two factors did not interact. In other words, recognisability changes were found for both attractiveness (mainly due to hit rate) and delay (mainly due to false alarm rate). These results do not support those of Shepherd and Ellis (1973), who found strong evidence for an interaction between attractiveness and delay. At least three reasons why the present study results differed from those of Shepherd and Ellis (1973) can be identified. Firstly, attractiveness level was treated as a between-subjects factor in the present study in order to minimise interference between groups. It is possible that there were interference effects in the Shepherd and Ellis study because participants saw all three sets of faces. Secondly, a 1AFC presentation mode was used in the present study. However, since SDT predicts no difference between and 1AFC and 2AFC performance, it seems more likely that using different participants for each level of attractiveness may be a critical factor in the failure to replicate Shepherd and Ellis' results. Finally, a 28-day delay was used in the present study to examine face recognition over time, as opposed to the 35-day employed by Shepherd and Ellis. Thus, the possible interaction between attractiveness level and delay may have occurred in the present study with a longer time delay.

### *Validity Check on d'*

The recognisability index, *d'*, is a parametric statistic where the underlying distribution of old and new faces are assumed to be normal with equal variances. To check that this assumption was reasonable, an alternative, non-parametric index, *A'*, was calculated for each participant. Table 8 shows the means and standard deviations for this index. The results for *A'* closely parallels the means and standard deviations found for *d'*. This impression was confirmed with an ANOVA using *A'* as the dependent measure, as can be seen in Table 9.

As Table 9 indicates, there were main effects for attractiveness, $F(2,52) = 4.86$, $p = .01$, $ES = 0.43$, and delay, $F(1,52) = 8.23$, $p = .01$, $ES = 0.40$, but no interaction between these two factors, $F(2,52) = 0.86$, $p = .42$, $ES = 0.18$. This comparison between *d'* and *A'* is rarely conducted. The results of the present study suggest that *d'* is an acceptable estimate of recognition accuracy for the present study. This finding supports earlier work by Podd (1990) who, using photofit faces in a study of memory load (number of targets to be remembered) and delay, also found no differences between the *d'* and *A'* measures.

Table 8

*Means (M) and standard deviations (SD) for A'*

| Group | Delay | *M* | *SD* |
|---|---|---|---|
| High[a] | 10 min | 0.92 | 0.04 |
| | 28 days | 0.86 | 0.07 |
| | Total | 0.89 | 0.06 |
| Medium[b] | 10 min | 0.88 | 0.05 |
| | 28 days | 0.79 | 0.13 |
| | Total | 0.84 | 0.12 |
| Low[c] | 10 min | 0.91 | 0.04 |
| | 28 days | 0.89 | 0.07 |
| | Total | 0.90 | 0.06 |
| Total | 10 min | 0.90 | 0.04 |
| | 28 days | 0.85 | 0.10 |
| | Total | 0.88 | 0.08 |

[a] High level of facial attractiveness. [b] Medium level of facial attractiveness. [c] Low level of facial attractiveness.

Overall, the present results show that facial attractiveness does affect recognition accuracy, mainly as a result of changes in hit rate. On the other hand, delay also affects accuracy but mainly as a result of increasing false alarms. Contrary to the findings of Shepherd and Ellis (1973), the present investigation found no evidence of an interaction between attractiveness and delay.

Table 9

*ANOVA summary for A'*

| Source | *SS* | *df* | *MS* | *F* | Sig. | *ES* |
|---|---|---|---|---|---|---|
| ATTRACT | 0.05 | 2 | 0.03 | 4.86 | .01 | .43 |
| DELAY | 0.04 | 1 | 0.04 | 8.23 | .01 | .40 |
| ATTRACT*DELAY | 0.01 | 2 | 0.00 | 0.86 | .42 | .18 |
| Error | 0.27 | 52 | 0.01 | | | |
| Total | 0.37 | 58 | | | | |
| Corrected Total | 0.37 | 57 | | | | |

***Criterion Changes***

Few investigations of facial recognition have examined data for shifts in response criterion (*c*). In the present study this statistic was calculated using *c* (MacMillan & Creelman, 1991). Criterion values of 0.00 represent a neutral criterion (an equal bias to reporting faces as old or new), positive values indicate a bias towards reporting faces as new, and negative values indicate a bias towards reporting faces as old. Criterion values were calculated for each participant and Table 10 shows the means and standard deviations for *c* as a function of attractiveness and delay.

As Table 10 illustrates, the mean *c* value differences from 0.00 (neutral criterion) are small compared to the standard deviations, and the values suggest little or no consistent change in *c* values for attractiveness or delay.

Table 10

*Means (M) and standard deviations (SD) for response criterion (c)*

| Group | Delay | *M* | *SD* |
|---|---|---|---|
| High[a] | 10 min | -.06 | 0.48 |
| | 28 days | .22 | 0.82 |
| | Total | .07 | 0.66 |
| Medium[b] | 10 min | .27 | 0.63 |
| | 28 days | -.20 | 0.65 |
| | Total | .04 | 0.67 |
| Low[c] | 10 min | -.00 | 0.65 |
| | 28 days | -.22 | 0.73 |
| | Total | -.11 | 0.68 |
| Total | 10 min | .07 | 0.59 |
| | 28 days | -.07 | 0.73 |
| | Total | .00 | 0.66 |

[a] High level of facial attractiveness. [b] Medium level of facial attractiveness. [c] Low level of facial attractiveness.

As the ANOVA shows in Table 11, none of the changes in *c* were statistically significant. No significant main effect was found for delay, $F(1,52) = 0.62$, $p = .44$, $ES = 0.11$, or attractiveness, $F(2,52) = 0.44$, $p = .65$, $ES = 0.13$, or for the interaction between attractiveness and delay $F(2,52) = 1.52$, $p = .23$, $ES = 0.24$.

Therefore, it seems that the changes observed in hit and false alarm rates are due to changes in recognisability and not changes in decision bias. This finding is important because few, if any, previous face recognition studies have assessed response bias changes. The present findings clearly show that neither attractiveness nor delay has any influence on this variable.

Table 11

*ANOVA summary for response criterion*

| Source | *SS* | *df* | *MS* | *F* | Sig. | *ES* |
|---|---|---|---|---|---|---|
| ATTRACT | 0.39 | 2 | .20 | 0.44 | .65 | .13 |
| DELAY | 0.27 | 1 | .27 | 0.62 | .44 | .11 |
| ATTRACT*DELAY | 1.35 | 2 | .68 | 1.52 | .23 | .24 |
| Error | 23.07 | 52 | .44 | | | |
| Total | 25.08 | 58 | | | | |
| Corrected Total | 25.09 | 57 | | | | |

In summary, the goal of Experiment 1 was to investigate the effects of facial attractiveness and delay on facial recognition in a partial replication of a study of these factors by Shepherd and Ellis (1973). As expected, the results confirm the importance of attractiveness and delay on face recognition performance. Specifically, faces that are high or low in attractiveness appear to be more easily recognised over time that faces previously rated medium in facial attractiveness. This result was mainly due to an increased hit rate for the attractiveness variable, with delay having an effect primarily due to increased false alarm rate. However, there was no evidence for an interaction between delay and attractiveness as found by Shepherd and Ellis. Differences in methodology between the two studies may account for this outcome.

Another possible factor that may have contributed to the failure to replicate the Shepherd and Ellis (1973) results is the level of distinctiveness (atypicality) of the faces used in each study. Shepherd and Ellis suggest that distinctiveness may account for the interaction they found. It is possible that the distinctiveness of the faces in the present study varied from that in Shepherd and Ellis' study. Sarno and Alley (1997) argue that facial attractiveness and distinctiveness may be confounded. Therefore, it seemed worthwhile to investigate the distinctiveness of the faces used in the present study. If Shepherd and Ellis were correct, then one would predict a curvilinear relationship between attractiveness and distinctiveness. That is, faces of medium attractiveness should be rated as less distinctive (more typical) than faces of high or low attractiveness.

# EXPERIMENT 2: FACIAL DISTINCTIVENESS

## INTRODUCTION

One of the most frequently studied variables in face recognition recently is facial distinctiveness. According to the von Restorff effect, distinctive objects are more memorable than those which are common or similar (Hunt, 1995). As a result, highly distinctive faces should produce fewer errors of omission (misses) and commission (false alarms), as originally proposed by Ford (1958). This concept is mirrored by Shepherd and Ellis (1973) who suggest that distinctiveness underlies effects of facial attractiveness. Consequently, facial attractiveness and its relationship to distinctiveness needs to be examined in more depth.

### *Facial Distinctiveness*

Distinctiveness can be defined as "clearly marking a person or thing as different from others" (Summers, 1992, p.297). As mentioned earlier, facial distinctiveness is currently generating considerable interest in face research (Sarno & Alley, 1997), and has been found to be a significant factor in many studies (Bruce, 1988; Shepherd et al., 1991).

#### *Research Findings*

There has been extensive research conducted in the area of facial distinctiveness and recognition memory. Many studies have demonstrated that distinctiveness is a key factor in face recognition (e.g., Bartlett, Hurry, & Thorley, 1984; Cohen & Carr, 1975; Going & Reed, 1974; Light, Kayra-Stuart, & Hollander, 1979; Winograd, 1981). In addition, unfamiliar faces tend to be more successfully identified if the element of distinctiveness is present (Light et al., 1979). This high recognition rate for distinctive faces not only contributes to more correct identifications of faces, that is, more hits, but also to a lower incidence of false alarms (Bartlett et al., 1984).

One of the most important studies on facial distinctiveness and memorability was conducted by Light et al. (1979). Recognition memory for typical and unusual faces was investigated with retention intervals from 3 to 24 hrs. Results suggested that hit rates increased and false alarm rates decreased with distance from the typical faces. In other words, faces rated as unusual or distinctive were more memorable. This was true for both intentional and incidental learning conditions, with presentation rates varying from 3 s to 15 s per item. Inter-item similarity was suggested as the structural basis of the typicality effect found where faces that are more similar to each other were discovered to be less memorable.

Another significant study on distinctiveness and memorability was conducted by Courtois and Mueller (1981) on target and distractor typicality in face recognition. It was hypothesised that common (unusual) target faces affected memorability because of the distinctiveness of the other choices during a test phase. Four types of test arrays were created: typical target-typical distractors, typical target-atypical distractors, atypical target-typical distractors, and atypical target-atypical distractors, with delays of immediately, 2 days, and 28 days. Among other results, higher recognition rates were found when either the target or distractor faces were distinctive, with no target by distractor interaction. As expected, typical distractors led to more false alarms, with delay effects occurring between 1 min and 2 days, and 2 and 28 days.

Similarly, Shepherd et al. (1991) studied the effect of facial distinctiveness on speed and accuracy of recognition rates following various presentation times and retention intervals. The main findings were: 1) hits decreased with increased delay; 2) false alarms increased and *d'* decreased with shorter presentation time; 3) distinctive faces received more hits and higher *d'* than non-distinctive faces; 4) response latencies were shorter for distinctive targets than for distinctive distractors or non-distinctive targets or distractors. Results replicated earlier studies (Light et al., 1979; Valentine & Bruce, 1986).

One factor that has been found to interact with distinctiveness is delay between presentation and testing (Shepherd et al., 1991). As mentioned earlier, Courtois and Mueller extensively investigated this in 1981 and found that distinctiveness and delay affected correct identifications of faces. Specifically, there were "greater increases in false positives for typical than for atypical faces over the longer delay intervals" (p.138).

In some respects, previous results obtained for facial distinctiveness are similar to those obtained for facial attractiveness in the present study. For instance, the more attractive faces produced the fewest errors of commission (the most hits), just as Ford (1958) predicted would be the case for distinctive faces. Indeed, several studies have now been conducted that suggest a relationship between distinctiveness and attractiveness.

***Facial Distinctiveness & Attractiveness***

Shepherd and Ellis (1973) appear to be amongst the earliest researchers to suggest that attractiveness and distinctiveness may be related. The question arises as to which of these variables best describes what it is about a face that participants respond to.

A critical study was reported by Light et al. (1981) who re-examined their earlier investigation (Light et al., 1979) on facial distinctiveness and memorability by suggesting that attractive faces are more difficult to remember. One hundred and twenty white male faces were rated for physical attractiveness by 31 male undergraduates. Standard recognition tests were then conducted the results of which indicated that faces rated highly attractive were more typical in appearance than those rated less attractive. Consequently, the attractive faces experienced a decrease in hit rate and increase in false alarm rate. In other words, faces that were atypical (relatively unattractive) in appearance were more memorable than faces typical (relatively attractive) in appearance.

Sarno and Alley (1997) suggest that greater memorability for attractive and unattractive faces "actually reflects variation in facial distinctiveness" (p.89). In other words, unattractive faces may be more easily recognised because of a distinctive or atypical element. As a result, Sarno and Alley investigated the independent and combined effects of attractiveness and distinctiveness on face recognition. The relationship between attractiveness and distinctiveness was examined by obtaining ratings of distinctiveness for a set of faces that had previously been rated for attractiveness, followed by a standard recognition test.

In a preliminary study, 45 male and 67 female participants rated the distinctiveness of 90 standardised facial photographs. These ratings and previously obtained ratings of attractiveness were used to select 12 target faces for a standard face recognition task, with the test set (target plus distractors) containing only 23 photographs. A total of 103 participants were run with the retention interval being 15 min.

Responses on the recognition task were converted to proportion of hits, proportion of false alarms, proportion correct, the number of hits over chance, and the number correct over chance. Results indicated that highly distinctive faces are more memorable. Furthermore, attractiveness was found to be a poor predictor of recognition accuracy when variation in distinctiveness was controlled for. Sarno and Alley (1997) suggest that a new perspective of the role of attractiveness in face recognition is needed; that is, it appears that facial attractiveness is best thought of as one property of a more fundamental concept, facial distinctiveness.

There are several criticisms of Sarno and Alley's (1997) study that need to be addressed. Firstly, the major criticism is that standard SDT analysis was not used. Rather, they used hit rate and false alarm rate and corrected these for guessing. They also used percentage correct (hit rate + correct rejection rate). This is not a good measure because it can be confounded by response bias. Thus, response bias should have been measured, too. It also appears that Sarno and Alley used hit rate as measure of recognition. But taken alone, hit rate is confounded by response bias. Furthermore, there were no SDT recognition measures, such as *d'*. Therefore, their results may not be reliable because of a failure to use the appropriate analytical techniques. Finally, the number of targets (12) and distractors (11) used is very small. For example, in estimating hit rate (proportion of 'old' responses to targets), the resolution is just one part in 12, or 8.5%. That is, one extra hit would change the overall hit rate by 8.5%.

Sarno and Alley (1997) claim that facial attractiveness has little or no effect on hit rate. The present study (Experiment 2) found a strong effect of attractiveness on hit rate. Thus, it seems that the relation between attractiveness and distinctiveness is in need of further clarification.

Sarno and Alley (1997) studied the relationship between attractiveness and distinctiveness by obtaining ratings of distinctiveness for a set of faces that had previously been rated for attractiveness. Next, the standard face recognition paradigm was initiated, where several combinations of distinctiveness and attractiveness were used. Another approach is possible where independent groups rate faces for attractiveness and distinctiveness and then the ratings are correlated. The present study provided an opportunity to do this. Experiment 1 examined recognition accuracy as a function of delay and attractiveness. Thus, Experiment 2 was designed to collect data on the distinctiveness of faces used in Experiment 1. It was then possible to correlate distinctiveness and attractiveness to examine the extent to which distinctiveness and attractiveness are related. If Shepherd and Ellis (1973) are correct in explaining their finding that medium attractive faces (typical faces) are less memorable than high and low attractive faces in terms of distinctiveness, then it is expected that the relationship between these two variables will be curvilinear.

## METHOD

### *Participants*

A total of 50 volunteers (25 male and 25 female, age range 19 to 26 years, $M$ = 21.74, $SD$ = 1.82) who were Massey University undergraduate and graduate students served as participants. Once again, participants were excluded from the study if they recognised any of the stimulus faces.

### *Materials & Design*

The stimulus pool of 78 colour slides used in Experiment 1 was used again. Each slide was given the original random number from Experiment 1 in order to compare ratings. In all other respects, the method of slide presentation and gathering of distinctiveness ratings was identical to that used to collect attractiveness ratings.

### *Procedure*

Participants rated each face independently for level of facial distinctiveness. Groups of 10 participants were asked to view the slides and rate each face for its facial distinctiveness on a 9-point scale ranging from *very indistinctive* to *very distinctive*, with scale anchor points provided at both the top and bottom of the response sheet (see Appendix D).

The instructions were read to the participants, informing them that ratings should be made after each slide was presented, during the 2-s interval (see Appendix D). Each participant was given a response sheet consisting of one double-sided page with two 20-spaced columns on each side. These items were numbered consecutively from 1 to 78. Each item on the response sheet corresponded to each of the slides. After viewing a slide, participants rated the distinctiveness of each face on the 9-point scale.

A brief break of approximately 30-s was provided to participants at the conclusion of 40 slides to allow a short rest, time to turn over their response sheet, and a chance to ensure that all items had been completed. As with the attractiveness ratings, none of the participants recognised any of the stimulus participants.

## RESULTS & DISCUSSION

The means and standard deviations for each slide rated for distinctiveness was initially computed separately for males and females (see Appendix E). Pearson's $r$ was calculated by correlating male and female ranks and a coefficient of $r = 0.92$ was obtained, very similar to the high correlation between males and females for attractiveness (0.95). Therefore, the ratings were collapsed over gender, and are presented in Table 13.

The distinctiveness ratings ranged from 3.70 to 7.26 ($M = 5.28$, $SD = 1.71$) on a 9-point scale. It is of interest to note that the corresponding attractiveness mean was only 3.68 with a standard deviation of 1.33. While the standard deviations for distinctiveness were homogeneous (most falling between 1.00 and 2.00), almost all the standard deviations for individual faces were large for the distinctiveness ratings than for the attractiveness ratings. Hence, there was considerably more variability in the distinctiveness ratings.

Table 13

*Distinctiveness ratings means (M) and standard deviations (SD) for each of the 78 stimulus photographs for males and females combined.*

| SN | *M* | *SD* | SN | *M* | *SD* |
|---|---|---|---|---|---|
| 1 | 4.56 | 1.47 | 41 | 4.10 | 1.46 |
| 2 | 5.22 | 1.52 | 42 | 4.08 | 1.38 |
| 3 | 4.66 | 1.85 | 43 | 4.78 | 1.67 |
| 4 | 5.18 | 1.59 | 44 | 5.74 | 1.80 |
| 5 | 4.76 | 1.72 | 45 | 5.58 | 1.75 |
| 6 | 6.46 | 1.89 | 46 | 5.64 | 1.71 |
| 7 | 6.58 | 1.91 | 47 | 4.66 | 1.65 |
| 8 | 6.88 | 1.90 | 48 | 5.18 | 1.78 |
| 9 | 4.62 | 1.51 | 49 | 4.68 | 1.56 |
| 10 | 5.42 | 1.57 | 50 | 4.78 | 1.57 |
| 11 | 5.38 | 1.46 | 51 | 5.46 | 1.89 |
| 12 | 5.02 | 1.86 | 52 | 7.08 | 2.22 |
| 13 | 5.42 | 1.65 | 53 | 7.26 | 2.06 |
| 14 | 6.44 | 1.76 | 54 | 7.00 | 1.88 |
| 15 | 6.22 | 1.81 | 55 | 5.32 | 1.58 |
| 16 | 5.12 | 1.66 | 56 | 5.52 | 1.74 |
| 17 | 3.70 | 1.50 | 57 | 4.86 | 1.77 |
| 18 | 5.72 | 2.02 | 58 | 4.52 | 2.00 |
| 19 | 5.26 | 1.98 | 59 | 5.04 | 1.73 |
| 20 | 4.92 | 1.77 | 60 | 5.00 | 1.28 |
| 21 | 7.00 | 1.83 | 61 | 4.50 | 1.52 |
| 22 | 3.88 | 1.17 | 62 | 4.60 | 1.39 |
| 23 | 4.74 | 1.56 | 63 | 4.46 | 1.50 |
| 24 | 4.06 | 1.42 | 64 | 4.18 | 1.42 |
| 25 | 6.48 | 1.80 | 65 | 5.42 | 1.80 |
| 26 | 5.96 | 2.13 | 66 | 5.14 | 1.94 |
| 27 | 4.34 | 1.59 | 67 | 5.22 | 1.95 |
| 28 | 7.04 | 1.98 | 68 | 6.72 | 1.82 |
| 29 | 4.88 | 1.45 | 69 | 6.64 | 1.51 |
| 30 | 4.12 | 1.36 | 70 | 5.28 | 1.74 |
| 31 | 4.82 | 1.66 | 71 | 4.96 | 1.80 |
| 32 | 4.58 | 1.62 | 72 | 5.46 | 1.83 |
| 33 | 4.70 | 1.82 | 73 | 5.84 | 1.73 |
| 34 | 4.54 | 1.59 | 74 | 4.78 | 1.66 |
| 35 | 4.52 | 1.55 | 75 | 5.46 | 1.91 |
| 36 | 4.54 | 2.07 | 76 | 5.40 | 1.82 |
| 37 | 5.26 | 2.07 | 77 | 6.24 | 1.82 |
| 38 | 5.00 | 1.54 | 78 | 5.30 | 1.62 |
| 39 | 5.60 | 1.82 | | | |
| 40 | 6.08 | 1.84 | | | |

Note. SN = Slide number

The distinctiveness and attractiveness ratings were correlated across all 78 faces. An overall correlation of $r$ = -0.51 was obtained using a simple linear fit. A scatter plot of the distinctiveness-attractiveness ratings was generated in order to check for any curvilinearity. This plot can be seen in Figure 2 and suggests that the relationship between these two variables is indeed curvilinear.

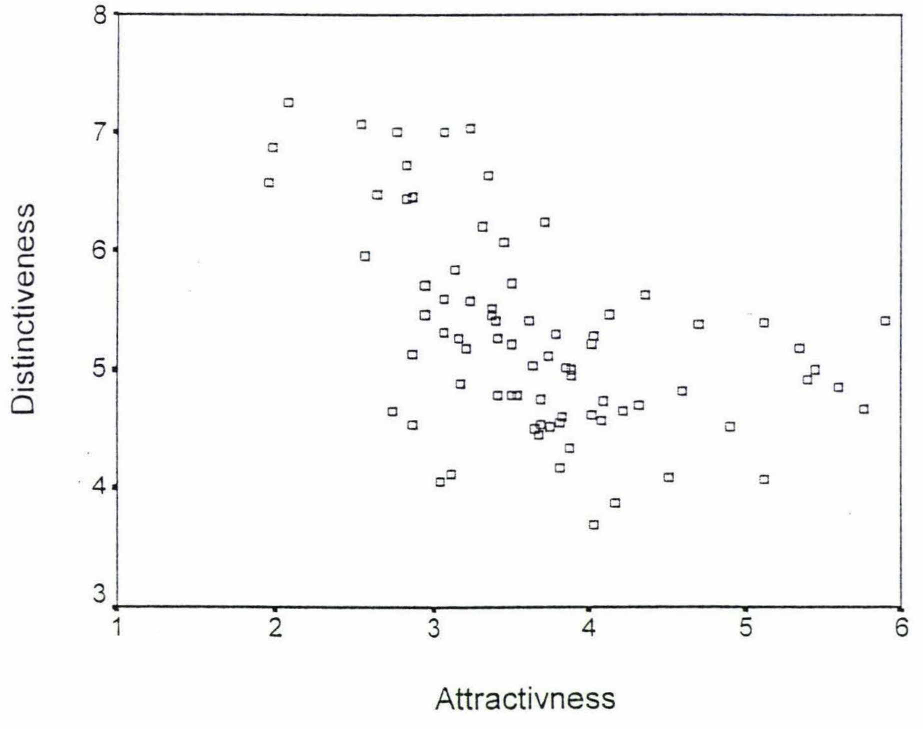


Figure 2: Scatter-plot of the relationship between facial attractiveness and distinctiveness for each of the 78 faces

A polynomial curve fitting procedure was applied to the data shown in Figure 2. The best fitting curves for the linear, quadratic, and cubic components are shown in Figure 3. These three components accounted for all the variance. The linear component accounted for about 25% of the variance while the quadratic and cubic (curvilinear) components accounted for the remaining 75% of the variance. Thus, the best description of the relationship between distinctiveness and attractiveness is that the two are curvilinearly related. Incidentally, as can be seen in Figure 3, the quadratic and cubic fits are almost identical in both shape and position.

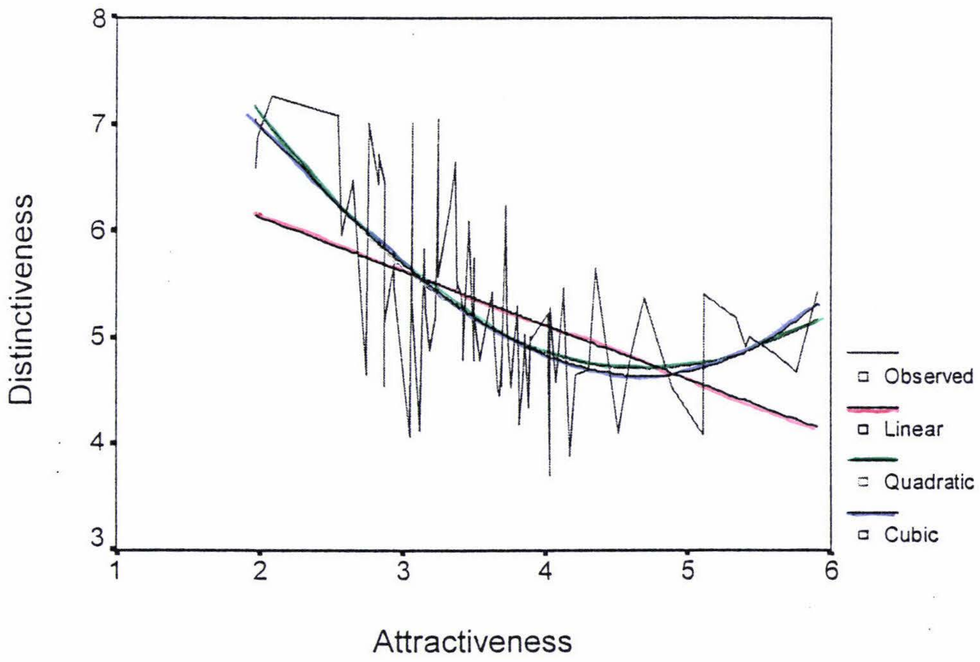


Figure 3: Curvilinear relationship between facial attractiveness and distinctiveness for the 78 faces. The linear, quadratic, and cubic components of the relationship are shown, these three components accounting for all the variation.

As Figure 3 illustrates, attractive faces are moderately distinctive, medium attractive faces are slightly less distinctive, and low attractive faces are highly distinctive.

The present results tended to support Shepherd and Ellis's (1973) speculation that attractive and unattractive faces are more memorable because they are distinctive. Furthermore, the present results also support Sarno and Alley's (1997) finding that more distinctive faces appear to be more memorable. However, Sarno and Alley found no significant relationship between attractiveness and memorability, clearly opposing the results found in the present study.

In summary, the objective of Experiment 2 was to examine the relationship between facial attractiveness and distinctiveness. As expected, a curvilinear relationship was found between the attractiveness and distinctiveness ratings, as suggested by Shepherd and Ellis (1973). Thus, faces of medium attractiveness appear to be less distinctive (more typical) than faces of high or low attractiveness. This result suggests that highly attractive and unattractive faces would be more memorable than average attractive faces. Research supports these results, such as Brigham (1990), who also found a U-shaped curvilinear relationship between distinctiveness and attractiveness.

# GENERAL DISCUSSION & CONCLUSIONS

The experiments reported in the present study reveal that facial attractiveness and distinctiveness are strongly correlated. Specifically, faces of low attractiveness are highly distinctive, faces of high attractiveness are moderately distinctive, and faces of medium attractiveness are least distinctive. No delay by attractiveness level interaction was found for any of the measures used, and the results therefore failed to replicate findings of Shepherd and Ellis (1973). Although there was a strong relationship between distinctiveness and attractiveness, it is not clear from the present investigation whether distinctiveness is the 'explanation' for the effects of attractiveness, as Shepherd and Ellis speculate. It may well be the case that attractiveness level affects the distinctiveness of a face, but attractiveness is a variable worthy of study in its own right and thus should be viewed as a concept different from distinctiveness.

Attractiveness and distinctiveness are speculated to be strongly correlated variables for several reasons. Shepherd and Ellis (1973) suggest that faces are not remembered as patterns or configurations but rather by identifying specific cues or features, a position consistent with that argued by Galper and Hochberg (1971). Thus, specific distinguishing features may make faces more attractive or unattractive and hence more memorable.

Sarno and Alley (1997) support this opinion by proposing that less attractive faces may be more memorable because they are more distinctive or atypical. According to Vokey and Read (1992), typicality is composed of two orthogonal components: general familiarity and memorability. General familiarity incorporates attractiveness and is positively correlated with typicality. The second component, memorability, is related to distinctive features and is inversely correlated with typicality. Consequently, the distinctive feature of memorability implies that attractiveness effects on face recognition may be mediated by just one or two components of typicality.

There was quite a lot of variability in judging faces for facial distinctiveness in the present study, suggesting that both this variable and facial attractiveness may not be unidimensional. That is, different participants may use different strategies or dimensions when judging attractiveness and distinctiveness in a face. Therefore, an investigation of the dimensionality of these concepts using perhaps multi-dimensional scaling is required. If participants are using different dimensions then much of the variation in ratings may be due to this unwanted factor. Researchers need to be confident that participants are treating distinctiveness and attractiveness as unidimensional constructs. These constructs may mean different things to different people and consequently this matter needs further exploration.

Relatively high standard deviations in the distinctiveness ratings may have due to participants' lack of understanding of the term 'distinctive'. In retrospect it may have been better to use labels such as 'very typical' and 'very unusual'. These labels may have given participants a greater understanding of distinctiveness and thus created greater conformity for ratings.

Furthermore, correlating the variables is not the strongest way to investigate the relationship between attractiveness, distinctiveness, and memorability. Rather, previously scaled faces on the dimension of distinctiveness and attractiveness need to be incorporated into the same study (c.f., Sarno & Alley, 1997). Specifically, one group recognises faces (after a delay) that have been scaled for distinctiveness alone, another for attractiveness alone and another where joint ratings of distinctiveness and attractiveness have been obtained. It should then be possible to tease out the contributions each factor makes to face memorability.

## LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

There were some design and procedural problems in the present study that may have affected results and consequently need to be addressed. Firstly, a sample of convenience was used, in which volunteers composed the sample. Consequently, external validity is questionable and generalisations to populations should be made with caution. However, Shepherd et al. (1981) made several comparisons between students and non-students as participants and found no major differences in identification studies.

Another design problem consisted of the 10-min time delay between study and test phase, which, in retrospect, could have been better controlled. Results may have varied if participants had been engaged in an activity unrelated to the memory experiment. For example, Sarno and Alley (1997) conducted a survey irrelevant to their study during their 15-min retention interval. This practice avoids discussion amongst participants about the faces seen in the presentation and allows a break from the study. However, caution is needed in order to avoid the introduction of interference, which may add to forgetting.

Another delay period would have been useful, such as 56 days. It would be very interesting to observe what happens to hit and false alarm rates with a longer delay, and how attractiveness levels affects this. Most face research suffers from the problem that the delay periods are not long enough. A weakness in the present study's replication is that the interaction Shepherd and Ellis (1973) found between delay and attractiveness may have been because they went in to a 35 day delay – a week longer than the present study. Future research needs to be conducted on longer delay periods. How recognisiability, hit rate, and false alarm rate, change over delays of up to, say, one year would provide very important data on the forgetting curves for face stimuli.

Surprisingly, little research has investigated what attributes of a face determine ease of recognition. In particular, facial attractiveness, while extensively researched, has revealed little about what aspects of the face are most important in defining attractive (or distinctive) features. In other words, what makes a person attractive? Berscheid and Walster (1974) state this dilemma eloquently by commenting:

> What physical characteristics entitle a person to the legacy of the physical attractiveness stereotype? The question of who is physically attractive, and why, is one that has fascinated novelists, poets, and street-corner pundits for centuries. Unfortunately, the popularity of the question is not reflected in the definitiveness of available answers (p.177).

These comments apply equally well to a number of other psychological constructs used for describing faces, for instance, 'distinctiveness', 'aggressiveness', and 'criminal'. Research is required that determines what it is about facial features, alone or in combination, that causes people to use such labels to describe a face.

Finally, more research needs to be conducted to discover why results are often inconsistent across studies. For example, the degree of target and distractor similarity may vary across studies and will reflect in recognition rates. It may be useful to develop standardised sets of target and distractor faces that have known quantified features.

## CONCLUSION

The aim of the present study was to replicate and extend the findings of Shepherd and Ellis (1973) that showed that attractiveness and delay interact in facial recognition. The present results confirmed the importance of facial attractiveness and time delay on face recognition performance, but did not support the idea that facial attractiveness and delay interact. The delay factor seems to cause a decrease in recognition mainly due to an increased false alarm rate whereas attractiveness seems to have its major impact of the hit rate. Even though there was no statistically significant interaction between attractiveness and delay, it can be noted that faces of medium attractiveness did suffer from the greatest decline in memorability over time compared to faces of high and low attractiveness level. These two groups produced almost identical results over time.

The results of a second small investigation revealed that facial attractiveness and distinctiveness are curvilinearly related, such that faces of low and high attractiveness are the most distinctive. Thus, while it can be concluded that distinctiveness and attractiveness are strongly related, it cannot be assumed that level of attractiveness affects memorability of a face over time *because* faces of a certain level attractiveness are more distinctive. Such an interpretation simply begs the question of what it is about a face that makes it distinctive (or attractive). Studies are required that use simplified faces (e.g., line drawings) where individual features can be altered systematically to vary distinctiveness. Such studies may help catalogue which facial features or global differences are most important when people rate a face's typicality.

As mentioned earlier, this finding that attractiveness affects memorability may actually result from a "confounding with distinctiveness" (Sarno & Alley, 1997, p.89), suggesting therefore that facial distinctiveness is an essential variable in face recognition performance. Since several authors have tried to link distinctiveness and attractiveness, the present study examined the correlation between these two factors. While the two factors are related, the present conclusion, unlike that of Sarno & Alley (1997), is that facial distinctiveness alone does not predict attractiveness; both factors probably make a contribution to face recognition over time. While facial distinctiveness and attractiveness are strongly related, it is suggested that there is more to attractiveness than just distinctiveness. Further research is needed to obtain a complete answer. However, future researchers should avoid the temptation of 'explaining' one psychological concept (physical attractiveness) with another (facial distinctiveness), as did Shepherd and Ellis (1973). While a physically attractive (or unattractive) face may be distinctive, to explain attractiveness in terms of distinctiveness simply begs the question of what it is about a face that makes it distinctive, attractive, or both.

# REFERENCES

Bahrick, H.P., Bahrick, P.O., & Wittlinger, R.P. (1975). Fifty years of memory for names and faces: A cross-sectional approach. *Journal of Experimental Psychology: General, 104*, 54-75.

Barkowitz, P., & Brigham, J.C. (1982). Recognition of faces: Own-race bias, incentive, and time delay. *Journal of Applied Social Psychology, 12*, 255-268.

Bartlett, J.C., Hurry, S., & Thorley, W. (1984). Typicality and familiarity of faces. *Memory and Cognition, 12*, 219-228.

Berscheid, E., & Walster, E. (1974). Physical attractiveness. In L. Berkowitz (Ed.)., *Advances in experimental social psychology, 7,* 157-215. New York: Academic Press.

Brigham, J.C. (1990). Target person distinctiveness and attractiveness as moderator variables in the confidence-accuracy relationship in eyewitness identification. *Basic and Applied Social Psychology, 11*, 101-115.

Brown, L. (Ed.). (1993). *The new shorter Oxford English dictionary on historical principles* (Volume 1, A-M). Oxford: Oxford University Press.

Bruce, V. (1988). *Recognising faces.* Hillsdale, NJ: Erlbaum.

Carey, S. (1981). The development of face perception. In G.M. Davies, H.D. Ellis, and J.W. Shepherd (Eds.), *Perceiving and remembering faces* (pp. 9-38). London: Academic Press.

Carey, S., Diamond, R., & Woods, B. (1980). The development of face recognition: A maturational component? *Developmental Psychology, 16*, 257-269.

Chance, J.E., & Goldstein, A.G. (1987). Retention interval and face recognition: Response latency measures. *Bulletin of the Psychonomic Society, 25*, 415-418.

Cohen, J. (1988). *Statistical power analysis for the behavioural sciences* (2nd ed.). NJ: Erlbaum.

Cohen, M.E., & Carr, W.J. (1975). Facial recognition and the von Restorff effect. *Bulletin of the Psychonomic Society, 6*, 383-384.

Cross, J.F., & Cross, J. (1971). Age, sex, race and the perception of facial beauty. *Developmental Psychology, 5*, 433-439.

Cross, J.F., Cross, J., & Daly, J. (1971). Sex, race, age, and beauty as factors in recognition of faces. *Perception and Psychophysics, 10*, 393-396.

Courtois, M.R., & Mueller, J.H. (1981). Target and distractor typicality in facial recognition. *Journal of Applied Psychology, 66*, 639-645.

Cutler, B.L., & Penrod, S.D. (1989). Moderators of the confidence-accuracy correlation in face recognition: The role of information processing and base rates. *Applied Cognitive Psychology, 3*, 95-107.

Darwin, C. (1872). *The expression of the emotions in man and animals.* London: Murray.

Darwin, C. (1952). The origin of species by means of natural selection. The decent of man and selection in relation to sex. In *Great Books of the Western World, 49*. Darwin, Chicago: Encyclopaedia Britannica.

Davies, G., Ellis, H., & Shepherd, J. (Eds.). (1981). *Perceiving and remembering faces*. New York: Academic Press.

Deffenbacher, K.A. (1986). On the memorability of the human face. In H.D. Ellis, M.A. Jeeves, F. Newcombe and A. Young (Eds.), *Aspects of face processing*. Dordrecht: Martinus Nijhoff.

Deffenbacher, K.A., Carr, T.H., & Leu, J.R. (1981). Memory for words, pictures, and faces: Retroactive interference, forgetting, and reminiscence. *Journal of Experimental Psychology: Human Learning & Memory, 7*, 299-305.

de Boysson-Bardies, B., de Schonen, S., Jusczyk, P., MacNeilage, P., & Morton, J. (1993). *Developmental neurocognition: Speech and face processing in the first years of life*. Dordrecht, the Netherlands: Kluwer Academic.

Egan, D., Pittner, M., & Goldstein, A.G. (1977). Eyewitness identification: Photographs vs live models. *Law & Human Behaviour, 1*, 199-206.

Ellis, H.D. (1975). Recognising faces. *British Journal of Psychology, 66*, 409-426.

Ellis, H.D. (1981). Introduction. In G.M. Davies, H.D. Ellis, and J.W. Shepherd (Eds.), *Perceiving and remembering faces* (pp. 1-5). London: Academic Press.

Ellis, H.D. (1992). The development of face processing skills. In V. Bruce, A. Cowey, A.W. Ellis, & D.I. Perrett (Eds.), *Processing the facial image.* Oxford: Oxford University Press.

Fleishman, J.J., Buckley, M.L., Klosinsky, M.J., Smith, N., & Tuck, B. (1976). Judged attractiveness in recognition memory of women's faces. *Perceptual & Motor Skills, 43*, 709-710.

Flin, R.H. (1980). Age effects in children's memory for unfamiliar faces. *Developmental Psychology, 16*, 373-374.

Flin, R., & Dziurawiec, S. (1989). Developmental factors in face processing. In A.W. Young and H.D. Ellis (Eds.), *Handbook of research on face processing* (pp. 335-378). Amsterdam, The Netherlands: Elsevier Science.

Ford, C. (1958). *Has anybody seen me lately?* Garden City, NY: Doubleday.

Galper, R.E., & Hochberg, J. (1971). Recognition memory for photographs of faces. *American Journal of Psychology, 84*, 351-354.

Galton, F. (1883). *Inquires into human faculty and its development.* London: MacMillan.

Galton, F. (1907). *Inquires into human faculty and its development* (2nd ed.). London: J.M. Dent.

Gehring, R.E., Toglia, M.P., & Kimble, G.A. (1976). Recognition memory for words and pictures at short and long retention intervals. *Memory & Cognition, 4*, 256-260.

Going, M., & Read, J.D. (1974). Effects of uniqueness, sex of subject, and sex of photograph on facial recognition. *Perception and Motor Skills, 39*, 109-110.

Goldstein, A.G., & Chance, J.E. (1970). Visual recognition memory for complex configurations. *Perception & Psychophysics, 9*, 237-241.

Harmon, L.D. (1973). The recognition of faces. *Scientific American, 22*, 71-82.

Hecaen, H., & Angelergues, R. (1962). Agnosia for faces (prosopagnosia). *Archives of Neurology, 7*, 92-100.

Hogarth, W. (Burke, J. [Ed]). (1955). *The analysis of beauty: With rejected passages from the manuscript drafts and autobiographical notes.* London: Oxford University Press.

Hunt, R.R. (1995). The subtlety of distinctiveness: What von Restorff really did. *Psychonomic Bulletin & Review, 2*, 105-112.

Iliffe, A.H. (1960). A study of preferences in feminine beauty. *British Journal of Psychology, 51*, 267-273.

Johnson, M.H., & Morton, J. (1991). *Biology and cognitive development: The case of facial recognition.* Oxford, U.K.: Blackwell.

Krouse, F.L. (1981). Effects of pose, pose change, and delay on face recognition performance. *Journal of Applied Psychology, 66*, 651-654.

Langlois, J.H., & Roggman, L.A. (1990). Attractive faces are only average. *Psychological Science, 1*, 115-121.

Langlois, J.H., Roggman, L.A., & Rieser-Danner, L.A. (1990). Infants' differential social responses to attractive and unattractive faces. *Developmental Psychology, 26*, 153-159.

Laughery, K.R., Fessler, P.K., Lenorovitz, D.R., & Yoblick, D.A. (1974). Time delay and similarity effects in facial recognition. *Journal of Applied Psychology, 59*, 490-496.

Laughery, K.R., & Wogalter, M.S. (1989). Forensic applications of facial memory research. In A.W. Young and H.D. Ellis (Eds.), *Handbook of research on face processing* (pp. 519-555). Amsterdam: Elsevier.

Light, L.L., Hollander, S., & Kayra-Stuart, F. (1981). Why attractive people are harder to remember. *Personality and Social Psychology Bulletin, 7*, 269-276.

Light, L.L., Kayra-Stuart, F., & Hollander, S. (1979). Recognition memory for typical and unusual faces. *Journal of Experimental Psychology: Learning, Memory, & Cognition, 5*, 212-228.

MacMillan, N.A., & Creelman, C.D. (1991). *Detection theory: A user's guide.* New York: Cambridge University Press.

McNicol, D. (1972). *A primer of signal detection theory*. London: George Allen & Unwin.

Peters, A. (1917). Gefuhl und Wiedererkennen. *Fortschritte der Psychologie und ihrer Anwendungen, 4*, 120-133.

Pascalis, O., de Hann, M., Nelson, C.A., & de Schonen, S. (1998). Long-term recognition memory for faces assessed by visual paired comparison in 3-

month and 6-month-old infants. *Journal of Experimental Psychology: Learning, Memory, & Cognition, 24*, 249-260.

Podd, J. (1990). The effects of memory load and delay on facial recognition. *Applied Cognitive Psychology, 4*, 47-59.

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

Sarno, J.A., & Alley, T.R. (1997). Attractiveness and the memorability of faces: Only a matter of distinctiveness? *American Journal of Psychology, 110*, 81-92.

Shapiro, P.N., & Penrod, S. (1986). Meta-analysis of facial identification studies. *Psychological Bulletin, 100*, 139-156.

Shepherd, J.W (1981). Social factors in face recognition. In G.M. Davies, J.W. Shepherd, and H.D. Ellis (Eds.), *Perceiving and remembering faces* (pp. 55-80). London: Academic Press.

Shepherd, J.W., & Ellis, H.D. (1973). The effect of attractiveness on recognition memory for faces. *American Journal of Psychology, 86*, 627-633.

Shepherd, J.W., Gibling, F., & Ellis, H.D. (1991). The effects of distinctiveness, presentation time and delay on face recognition. *European Journal of Cognitive Psychology, 3*, 137-145. In V. Bruce (Ed.), *Face recognition*. East Sussex, UK: Lawrence Erlbaum.

SPSS Inc. (1999). *SPSS for windows*. Chicago: Author.

Summers, D. (Ed.). (1992). *Longman dictionary of contemporary English* (2nd ed.). Essex, England: Longman Group.

Thornton, G.R. (1939). Defendant's attractiveness as a factor in the outcome of criminal trials: An observational study. *Journal of Applied Social Psychology, 10*, 348-361.

Valentine, T., & Bruce, V. (1986). Recognizing familiar faces: The role of distinctiveness and familiarity. *Canadian Journal of Psychology, 40*, 300-305.

Vokey, J.R., & Read, J.D. (1992). Familiarity, memorability, and the effect of typicality on the recognition of faces. *Memory and Cognition, 20*, 291-302.

Walker-Smith, G.J. (1978). The effects of delay and exposure duration in a face recognition task. *Perception and Psychophysics, 24*, 63-70.

Warrington, E.K., & James, M. (1967). An experimental investigation of facial recognition in patients with unilateral cerebral lesions. *Cortex, 3*, 317-326.

Winograd, E. (1981). Elaboration and distinctiveness in memory for faces. *Journal of Experimental Psychology: Human Learning and Memory, 7*, 181-190.

Yarmey, A.D. (1971). Recognition memory for familiar 'public' faces: Effects of orientation and delay. *Psychonomic Science, 24*, 286-288.

Yarmey, A.D. (1979). The effects of attractiveness, feature saliency and liking on memory for faces. In M. Cook and G. Wilson (Eds.), *Love and attraction* (pp. 51-53). New York: Pergamon.

Yin, R.K. (1969). Looking at upside-down faces. *Journal of Experimental Psychology, 81*, 141-145.

Young, A.W. (1987). Face recognition. In H. Beloff and A.M. Colman, *Psychological Survey* (vol 6) (pp. 28-54). Leicetser, UK: British Psychological Society.

Young, A.W., & Bruce, V. (1991). Perceptual categories and the computation of 'grandmother'. *European Journal of Cognitive Psychology, 3*, 5-49.

Young, A.W., & Ellis, H.D. (Eds.). (1989). *Handbook of research on face processing*. Amsterdam, the Netherlands: Elsevier Science.

# APPENDIX A

## ATTRACTIVENESS RATINGS

- Information Sheet
- Consent Form
- Verbal Instructions given to Participants
- Rating Response Sheet

**Massey University**
COLLEGE OF HUMANITIES & SOCIAL SCIENCES

**School of Psychology**
Private Bag 11 222,
Palmerston North,
New Zealand
Telephone: 64 6 356 9099
Facsimile: 64 6 350 5673

***The Effects of Attractiveness and Retention Interval on Facial Recognition***

## INFORMATION SHEET
**Group A**

Hi. My name is Jennifer Barbour from Massey University. I am doing a study on whether very attractive and unattractive faces are more memorable than 'average' faces for my Masters thesis. You are invited to take part in this study by participating in a brief slide presentation. This preliminary part of the study requires you to rate a series of faces for attractiveness.

If you agree to take part in this project you will be invited to view a slide presentation with other people that will take about 20 minutes of your time. Your participation in this study is voluntary and you will be asked to sign a consent form.

Your rights as stated in the *Massey University Code of Ethical Conduct* booklet are:
- To decline participation
- To refuse to answer any particular questions
- To withdraw from the study at any time
- To have privacy and confidentiality protected
- To ask questions at any time
- To be given access to a summary of the findings when the study is concluded

You can contact me by leaving a message for Jennifer Barbour at the School of Psychology office, Massey University, on (06) 350 4118. In addition, you can write to me c/o the School of Psychology office, Massey University, Private Bag 11222, Palmerston North. Alternatively, you can contact my supervisor, Dr. John Podd, on (06) 350 5799, ext. 2067.

A vital concern is the importance of confidentiality in research. Consequently, responses will be kept confidential to myself and my supervisor, Dr. John Podd. At no time will forms be identified by name. The information you are giving for this study will remain confidential and you will be unable to be identified in the final report.

**Massey University**
COLLEGE OF HUMANITIES & SOCIAL SCIENCES

School of Psychology
Private Bag 11 222,
Palmerston North,
New Zealand
Telephone: 64 6 356 9099
Facsimile: 64 6 350 5673

*The Effects of Attractiveness and Retention Interval on Facial Recognition*

## CONSENT FORM

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I understand I have the right to withdraw from the study at any time and to decline to answer any particular questions. I also understand that I will be in a group of ten participants and my responses will remain confidential to the researcher and supervisor.

I agree to provide information to the researchers on the understanding that my name will not be used without my permission. (*The information will be used only for this research and publications arising from this research project*).

I agree to participate in this study under the conditions set out in the information sheet.

**Signed:** ..........................................................................................

**Name:** ..........................................................................................

**Date:** ..........................................................................................

If you would like a summary of the findings when the study is concluded please give your contact details here:

**Phone Number:** ..............................................................

**Address:** ..............................................................

..............................................................

# INSTRUCTIONS - ATTRACTIVENESS RATINGS

You are going to be shown a series of 78 slides of people's faces. Your task to rate each faces for its *physical attractiveness*. The scale for each slide ranges from 1 to 9, 1 indicating that you think the face is very unattractive, 9 indicating that you think the face is very attractive. Circle your chosen rating for each face next to the corresponding slide number on the response sheet. You will be given 5 seconds to record your response for each slide.

There are a couple of important things that you need to know before we begin. Firstly, all the slides are of men. Also, since the pictures were taken about 10 years ago there may be some minor differences in appearance compared to present day appearances. Finally, although most of the pictures are of young men in their late teens and early twenties, there are some older men featured. Compare these older men with others in their age group to decide level of attractiveness, not the other younger men in the sample.

I will stop briefly after 40 slides so that you can check that all your responses have been made for that block and to give you a brief break. Please do not talk to others during this slide presentation and if there are any questions I am happy to answer them for you before we begin. Finally, I would like to stress that the responses you make in this presentation are strictly confidential and will only be used for research purposes.

Now, are there any questions?

# ATTRACTIVENESS RATING SCALE

**Gender**: Male ☐ Female ☐ **Age**: _____

Please circle one number for each slide

| *Slide* | Very Unattractive | | | | | | | Very Attractive | | *Slide* | Very Unattractive | | | | | | | Very Attractive | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **21)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **2)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **22)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **3)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **23)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **4)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **24)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **5)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **25)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **6)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **26)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **7)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **27)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **8)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **28)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **9)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **29)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **10)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **30)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **11)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **31)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **12)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **32)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **13)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **33)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **14)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **34)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **15)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **35)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **16)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **36)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **17)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **37)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **18)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **38)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **19)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **39)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **20)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **40)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| *Slide* | Very Unattractive | | | | | | | Very Attractive | | *Slide* | Very Unattractive | | | | | | | Very Attractive | |

**Turn over page**

| *Slide* | Very Unattractive | | | | | | | Very Attractive |
|---|---|---|---|---|---|---|---|---|
| **41)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **42)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **43)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **44)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **45)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **46)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **47)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **48)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **49)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **50)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **51)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **52)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **53)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **54)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **55)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **56)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **57)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **58)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **59)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **60)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| *Slide* | Very Unattractive | | | | | | | Very Attractive |

| *Slide* | Very Unattractive | | | | | | | Very Attractive |
|---|---|---|---|---|---|---|---|---|
| **61)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **62)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **63)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **64)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **65)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **66)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **67)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **68)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **69)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **70)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **71)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **72)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **73)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **74)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **75)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **76)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **77)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **78)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| *Slide* | Very Unattractive | | | | | | | Very Attractive |

# APPENDIX B

## MEAN ATTRACTIVENESS RATINGS

- Mean attractiveness ratings for each of the 78 stimulus photographs as judged by 25 males and 25 females

Mean (*M*) attractiveness ratings and standard deviations (*SD*) for the 78 stimulus photographs as judged by 25 females and 25 males using a 9-point scale (1 = least attractive, 9 = most attractive).

| | Females | | Males | |
|---|---|---|---|---|
| Slide Number | *M* | *SD* | *Males* | *SD* |
| 1 | 3.72 | 1.37 | 3.92 | 1.26 |
| 2 | 3.44 | 1.12 | 4.60 | 1.22 |
| 3 | 2.60 | 1.04 | 2.88 | 1.13 |
| 4 | 5.28 | 1.54 | 5.40 | 1.26 |
| 5 | 3.52 | 1.26 | 3.88 | 1.01 |
| 6 | 2.64 | 1.35 | 3.08 | 1.41 |
| 7 | 1.88 | 0.83 | 2.04 | 0.98 |
| 8 | 1.80 | 0.87 | 2.16 | 1.37 |
| 9 | 3.88 | 1.51 | 4.16 | 1.11 |
| 10 | 6.00 | 1.38 | 5.80 | 1.29 |
| 11 | 4.60 | 1.35 | 4.80 | 0.76 |
| 12 | 4.00 | 1.26 | 3.72 | 1.10 |
| 13 | 3.52 | 1.19 | 3.72 | 1.10 |
| 14 | 2.68 | 1.25 | 2.96 | 1.37 |
| 15 | 3.24 | 1.76 | 3.40 | 1.22 |
| 16 | 3.68 | 1.46 | 3.80 | 1.35 |
| 17 | 3.88 | 1.42 | 4.20 | 1.19 |
| 18 | 2.96 | 1.46 | 2.92 | 1.04 |
| 19 | 3.00 | 1.50 | 3.32 | 1.44 |
| 20 | 5.44 | 1.66 | 5.36 | 1.15 |
| 21 | 3.08 | 1.32 | 3.04 | 1.72 |
| 22 | 4.08 | 1.29 | 4.28 | 1.46 |
| 23 | 3.88 | 1.42 | 4.32 | 1.38 |
| 24 | 2.92 | 1.12 | 3.16 | 1.14 |
| 25 | 2.48 | 0.96 | 2.80 | 1.32 |
| 26 | 2.44 | 1.19 | 2.68 | 1.41 |
| 27 | 3.56 | 1.42 | 4.20 | 1.15 |
| 28 | 3.28 | 1.62 | 3.20 | 1.66 |
| 29 | 3.04 | 1.27 | 3.32 | 1.52 |
| 30 | 3.04 | 0.98 | 3.20 | 1.32 |
| 31 | 4.48 | 1.19 | 4.72 | 1.62 |
| 32 | 4.36 | 1.22 | 3.80 | 1.26 |
| 33 | 4.60 | 1.50 | 4.04 | 1.49 |
| 34 | 3.60 | 1.38 | 3.80 | 0.96 |
| 35 | 3.72 | 1.37 | 3.80 | 1.08 |

**Continued over page**

| | Females | | Males | |
|---|---|---|---|---|
| Slide Number | *M* | *SD* | *Males* | *SD* |
| 36 | 2.72 | 1.21 | 3.00 | 1.35 |
| 37 | 3.16 | 1.43 | 3.68 | 1.35 |
| 38 | 5.40 | 1.80 | 5.48 | 1.58 |
| 39 | 2.92 | 1.35 | 3.20 | 1.35 |
| 40 | 3.32 | 1.38 | 3.60 | 1.38 |
| 41 | 4.68 | 1.38 | 4.36 | 1.66 |
| 42 | 5.32 | 1.44 | 4.92 | 1.15 |
| 43 | 3.40 | 1.12 | 3.60 | 1.19 |
| 44 | 3.60 | 1.50 | 3.40 | 1.41 |
| 45 | 2.96 | 1.06 | 3.52 | 1.05 |
| 46 | 4.28 | 1.90 | 4.44 | 1.50 |
| 47 | 4.08 | 1.53 | 4.36 | 1.35 |
| 48 | 3.04 | 1.17 | 3.40 | 1.12 |
| 49 | 5.80 | 1.80 | 5.72 | 1.40 |
| 50 | 3.44 | 1.12 | 3.64 | 1.41 |
| 51 | 3.40 | 1.35 | 3.36 | 1.04 |
| 52 | 2.28 | 1.02 | 2.80 | 1.04 |
| 53 | 2.08 | 1.32 | 2.08 | 1.26 |
| 54 | 2.68 | 1.38 | 2.84 | 1.57 |
| 55 | 2.92 | 1.29 | 3.20 | 1.15 |
| 56 | 3.40 | 1.32 | 3.36 | 1.25 |
| 57 | 5.68 | 1.38 | 5.52 | 1.39 |
| 58 | 5.04 | 1.46 | 4.76 | 1.36 |
| 59 | 3.60 | 1.15 | 3.68 | 0.99 |
| 60 | 3.80 | 1.19 | 4.00 | 1.47 |
| 61 | 3.28 | 1.24 | 4.04 | 1.34 |
| 62 | 3.72 | 1.46 | 3.96 | 1.54 |
| 63 | 3.52 | 1.53 | 3.84 | 1.57 |
| 64 | 4.00 | 1.26 | 3.64 | 1.32 |
| 65 | 3.40 | 1.53 | 3.40 | 1.12 |
| 66 | 2.92 | 1.15 | 2.80 | 1.00 |
| 67 | 3.52 | 1.81 | 3.48 | 1.33 |
| 68 | 2.72 | 1.59 | 2.92 | 1.44 |
| 69 | 3.16 | 1.25 | 3.56 | 1.36 |
| 70 | 4.08 | 1.61 | 4.00 | 1.53 |
| 71 | 3.72 | 1.37 | 4.08 | 1.32 |
| 72 | 4.16 | 1.55 | 4.12 | 1.79 |
| 73 | 2.96 | 1.14 | 3.32 | 1.03 |
| 74 | 3.28 | 1.24 | 3.56 | 1.36 |
| 75 | 2.72 | 1.17 | 3.16 | 1.46 |
| 76 | 5.00 | 1.58 | 5.24 | 1.45 |
| 77 | 3.52 | 1.42 | 3.92 | 1.22 |
| 78 | 3.64 | 1.41 | 3.96 | 1.24 |

# APPENDIX C

## FACE RECOGNITION STUDY

- Information Sheet
- Verbal Instructions given to Participants
- Facial Recognition Response Sheet

Massey University
COLLEGE OF HUMANITIES & SOCIAL SCIENCES

School of Psychology
Private Bag 11 222,
Palmerston North,
New Zealand
Telephone: 64 6 356 9099
Facsimile: 64 6 350 5673

*The Effects of Attractiveness and Retention Interval on Facial Recognition*

## INFORMATION SHEET
### Group B

Hi. My name is Jennifer Barbour from Massey University. I am doing a study on whether very attractive and unattractive faces are more memorable than 'average' faces for my Masters thesis. You are invited to take part in this project by participating in a slide presentation, followed by another brief presentation.

If you agree to take part in this project, you will be invited to view an initial slide presentation with other people, followed by another presentation, either immediately or 28 days later. Each presentation will take about 20 minutes of your time. Your participation in this study is voluntary and you will be asked to sign a consent form.

Your rights, as stated in the *Massey University Code of Ethical Conduct* booklet are:

- To decline participation
- To refuse to answer any particular questions
- To withdraw from the study at any time
- To have privacy and confidentiality protected
- To ask questions at any time
- To be given access to a summary of the findings when the study is concluded

You can contact me by leaving a message for Jennifer Barbour at the School of Psychology office, Massey University, on (06) 350 4118. In addition, you can write to me c/o the School of Psychology office, Massey University, Private Bag 11222, Palmerston North. Alternatively, you can contact my supervisor, Dr. John Podd, on (06) 350 5799, ext. 2067.

A vital concern is the importance of confidentiality in research. Consequently, responses will be kept confidential to myself and my supervisor, John Podd. At no time will forms be identified by name. The information you are giving for this study will remain confidential and you will be unable to be identified in the final report.

# INSTRUCTIONS - STUDY PHASE

You are going to be shown a series of 20 slides of men's faces. Each slide will be shown for 5 seconds. Your task is to sit back and watch, paying close attention to each face. Remember that you are going to be asked to recall these faces in the next slide presentation.

Please do not talk to others during this slide presentation and if there are any questions I am happy to answer them for you before we begin.

Now, are there any questions?

# INSTRUCTIONS – TEST PHASE

10 minutes/28 days ago, you were shown a series of 20 slides of men's faces. This slide presentation will include those 20 slides as well as another 20 different slides of men's faces that you have not seen before. All 40 slides have been combined in a random order.

Your task is to record which slides you saw 10 minutes/28 days ago. You have two choices: 'Yes' and 'No'. Tick 'yes' if you remember seeing that face in the first slide presentation. Tick 'no' if you think that the face was not in the first slide presentation. You will be given 7 (5 + 2) seconds to record your response for each slide. Please record a response for each slide. If you are unsure have a guess.

I will stop briefly after 20 slides so that you can check that all your responses have been made for that block. Please do not talk to others during this slide presentation and if there are any questions I am happy to answer them for you before we begin. Finally, I would like to stress that the responses you make in this presentation are strictly confidential and will only be used for research purposes.

Now, are there any questions?

# FACIAL RECOGNITION EXERCISE

**Gender**: ☐ Male **Age**: _____
☐ Female

Please tick the appropriate box for each slide

| Slide Number | Yes | No |
|---|---|---|
| 1 | ☐ | ☐ |
| 2 | ☐ | ☐ |
| 3 | ☐ | ☐ |
| 4 | ☐ | ☐ |
| 5 | ☐ | ☐ |
| 6 | ☐ | ☐ |
| 7 | ☐ | ☐ |
| 8 | ☐ | ☐ |
| 9 | ☐ | ☐ |
| 10 | ☐ | ☐ |
| 11 | ☐ | ☐ |
| 12 | ☐ | ☐ |
| 13 | ☐ | ☐ |
| 14 | ☐ | ☐ |
| 15 | ☐ | ☐ |
| 16 | ☐ | ☐ |
| 17 | ☐ | ☐ |
| 18 | ☐ | ☐ |
| 19 | ☐ | ☐ |
| 20 | ☐ | ☐ |
| **Slide Number** | **Yes** | **No** |

**Turn over page**

| Slide Number | Yes | No |
|---|---|---|
| 21 | ☐ | ☐ |
| 22 | ☐ | ☐ |
| 23 | ☐ | ☐ |
| 24 | ☐ | ☐ |
| 25 | ☐ | ☐ |
| 26 | ☐ | ☐ |
| 27 | ☐ | ☐ |
| 28 | ☐ | ☐ |
| 29 | ☐ | ☐ |
| 30 | ☐ | ☐ |
| 31 | ☐ | ☐ |
| 32 | ☐ | ☐ |
| 33 | ☐ | ☐ |
| 34 | ☐ | ☐ |
| 35 | ☐ | ☐ |
| 36 | ☐ | ☐ |
| 37 | ☐ | ☐ |
| 38 | ☐ | ☐ |
| 39 | ☐ | ☐ |
| 40 | ☐ | ☐ |
| **Slide Number** | **Yes** | **No** |

# APPENDIX D

## DISTINCTIVENESS RATINGS

- Information Sheet
- Verbal Instructions given to Participants
- Ratings Response Sheet

Massey University
COLLEGE OF HUMANITIES & SOCIAL SCIENCES

School of Psychology
Private Bag 11 222,
Palmerston North,
New Zealand
Telephone: 64 6 356 9099
Facsimile: 64 6 350 5673

*The Effects of Attractiveness and Retention Interval on Facial Recognition*

## INFORMATION SHEET

### Group C

Hi. My name is Jennifer Barbour from Massey University. I am doing a study on whether very attractive and unattractive faces are more memorable than 'average' faces for my Masters thesis. You are invited to take part in this study by participating in a brief slide presentation. This part of the study requires you to rate a series of faces for distinctiveness.

If you agree to take part in this project you will be invited to view a slide presentation with other people that will take about 20 minutes of your time. Your participation in this study is voluntary and you will be asked to sign a consent form.

Your rights,. as stated in the *Massey University Code of Ethical Conduct* booklet are:

- To decline participation
- To refuse to answer any particular questions
- To withdraw from the study at any time
- To have privacy and confidentiality protected
- To ask questions at any time
- To be given access to a summary of the findings when the study is concluded

You can contact me by leaving a message for Jennifer Barbour at the School of Psychology office, Massey University, on (06) 350 4118. In addition, you can write to me c/o the School of Psychology office, Massey University, Private Bag 11222, Palmerston North. Alternatively, you can contact my supervisor, Dr. John Podd, on (06) 350 5799, ext. 2067.

A vital concern is the importance of confidentiality in research. Consequently, responses will be kept confidential to myself and my supervisor, Dr. John Podd. At no time will forms be identified by name. The information you are giving for this study will remain confidential and you will be unable to be identified in the final report.

# INSTRUCTIONS - DISTINCTIVENESS RATINGS

You are going to be shown a series of 78 slides of people's faces. Your task to rate each faces for its *distinctiveness*. The scale for each slide ranges from 1 to 9. 1 indicating that you think the face is *very indistinctive*, to 9 indicating that you think the face is *very distinctive*. Circle your chosen rating for each face next to the corresponding slide number on the response sheet. You will be given 7 (5 + 2) seconds to record your response for each slide.

There are a couple of important things that you need to know before we begin. Firstly, all the slides are of men. Also, since the pictures were taken about 10 years ago there may be some minor differences in appearance. Finally, although most of the pictures are of young men in their late teens and early twenties, there are some older men featured. Compare these older men with others in their age group to decide level of distinctiveness, not the other younger men in the sample.

I will stop briefly after 40 slides so that you can check that all your responses have been made for that block and to give you a brief break. Please do not talk to others during this slide presentation and if there are any questions I am happy to answer them for you before we begin. Finally, I would like to stress that the responses you make in this presentation are strictly confidential and will only be used for research purposes.

Now, are there any questions?

# DISTINCTIVENESS RATING SCALE

**Gender**: Male ☐ Female ☐ **Age**: _____

Please circle one number for each slide

| *Slide* | Very Indistinctive | | | | | | | Very Distinctive | *Slide* | Very Indistinctive | | | | | | | | Very Distinctive |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **21)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **2)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **22)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **3)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **23)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **4)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **24)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **5)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **25)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **6)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **26)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **7)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **27)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **8)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **28)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **9)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **29)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **10)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **30)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **11)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **31)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **12)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **32)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **13)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **33)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **14)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **34)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **15)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **35)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **16)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **36)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **17)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **37)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **18)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **38)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **19)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **39)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **20)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **40)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| *Slide* | Very Indistinctive | | | | | | | Very Distinctive | *Slide* | Very Indistinctive | | | | | | | | Very Distinctive |

**Turn over page**

| *Slide* | Very Indistinctive | | | | | | | Very Distinctive | *Slide* | Very Indistinctive | | | | | | | Very Distinctive |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **41)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **61)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **42)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **62)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **43)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **63)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **44)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **64)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **45)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **65)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **46)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **66)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **47)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **67)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **48)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **68)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **49)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **69)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **50)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **70)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **51)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **71)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **52)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **72)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **53)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **73)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **54)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **74)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **55)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **75)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **56)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **76)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **57)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **77)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **58)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **78)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **59)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | | | | | | | | | |
| **60)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | | | | | | | | | |
| *Slide* | Very Indistinctive | | | | | | | Very Distinctive | *Slide* | Very Indistinctive | | | | | | | Very Distinctive |

# APPENDIX E

## MEAN DISTINCTIVENESS RATINGS

Mean distinctiveness ratings for each of the 78 stimulus photographs as judged by 25 males and 25 females

Mean (*M*) distinctiveness ratings and standard deviations (*SD*) for the 78 stimulus photographs as judged by 25 females and 25 males using a 9-point scale (1 = least distinctive, 9 = most distinctive).

| | Females | | Males | |
|---|---|---|---|---|
| Slide Number | *M* | *SD* | *M* | *SD* |
| 1 | 4.56 | 1.61 | 4.56 | 1.36 |
| 2 | 5.32 | 1.49 | 5.12 | 1.56 |
| 3 | 4.40 | 1.94 | 4.92 | 1.75 |
| 4 | 5.44 | 1.56 | 4.92 | 1.61 |
| 5 | 4.88 | 1.64 | 4.64 | 1.82 |
| 6 | 6.76 | 1.64 | 6.16 | 2.10 |
| 7 | 6.52 | 2.00 | 6.64 | 1.85 |
| 8 | 6.96 | 1.90 | 6.80 | 1.94 |
| 9 | 4.64 | 1.15 | 4.60 | 1.83 |
| 10 | 5.64 | 1.52 | 5.20 | 1.61 |
| 11 | 5.56 | 1.33 | 5.20 | 1.58 |
| 12 | 5.32 | 1.80 | 4.72 | 1.90 |
| 13 | 5.60 | 1.66 | 5.24 | 1.67 |
| 14 | 6.60 | 1.55 | 6.28 | 1.97 |
| 15 | 6.12 | 1.94 | 6.32 | 1.70 |
| 16 | 4.80 | 1.80 | 5.44 | 1.47 |
| 17 | 3.68 | 1.57 | 3.72 | 1.46 |
| 18 | 5.76 | 2.24 | 5.68 | 1.82 |
| 19 | 5.28 | 1.93 | 5.24 | 2.07 |
| 20 | 4.96 | 1.74 | 4.88 | 1.83 |
| 21 | 6.92 | 1.99 | 7.08 | 1.68 |
| 22 | 4.04 | 1.17 | 3.72 | 1.17 |
| 23 | 4.64 | 1.55 | 4.84 | 1.60 |
| 24 | 4.12 | 1.56 | 4.00 | 1.29 |
| 25 | 6.60 | 1.61 | 6.36 | 1.99 |
| 26 | 6.20 | 2.22 | 5.72 | 2.05 |
| 27 | 4.20 | 1.50 | 4.48 | 1.69 |
| 28 | 6.96 | 2.11 | 7.12 | 1.88 |
| 29 | 4.64 | 1.62 | 5.12 | 1.24 |
| 30 | 4.20 | 1.26 | 4.04 | 1.49 |
| 31 | 5.08 | 1.89 | 4.56 | 1.39 |
| 32 | 4.56 | 1.73 | 4.60 | 1.53 |
| 33 | 4.60 | 1.89 | 4.80 | 1.78 |
| 34 | 4.68 | 1.55 | 4.40 | 1.66 |
| 35 | 4.56 | 1.85 | 4.48 | 1.23 |

**Continued over page**

| | Females | | Males | |
|---|---|---|---|---|
| Slide Number | *M* | *SD* | *M* | *SD* |
| 36 | 4.64 | 2.16 | 4.44 | 2.02 |
| 37 | 5.24 | 2.18 | 5.28 | 1.99 |
| 38 | 4.92 | 1.75 | 5.08 | 1.32 |
| 39 | 5.40 | 1.96 | 5.80 | 1.68 |
| 40 | 6.32 | 1.86 | 5.84 | 1.82 |
| 41 | 4.28 | 1.65 | 3.92 | 1.26 |
| 42 | 4.12 | 1.54 | 4.04 | 1.24 |
| 43 | 4.92 | 1.80 | 4.64 | 1.55 |
| 44 | 5.40 | 2.04 | 6.08 | 1.50 |
| 45 | 5.64 | 1.82 | 5.52 | 1.71 |
| 46 | 5.68 | 1.91 | 5.60 | 1.53 |
| 47 | 4.28 | 1.51 | 5.04 | 1.72 |
| 48 | 5.12 | 1.69 | 5.24 | 1.90 |
| 49 | 4.76 | 1.67 | 4.60 | 1.47 |
| 50 | 4.60 | 1.66 | 4.96 | 1.49 |
| 51 | 5.44 | 1.92 | 5.48 | 1.90 |
| 52 | 6.80 | 2.58 | 7.36 | 1.80 |
| 53 | 7.36 | 1.87 | 7.16 | 2.27 |
| 54 | 7.20 | 1.80 | 6.80 | 1.98 |
| 55 | 5.12 | 1.67 | 5.52 | 1.50 |
| 56 | 5.60 | 1.73 | 5.44 | 1.78 |
| 57 | 4.76 | 1.92 | 4.96 | 1.65 |
| 58 | 4.32 | 2.14 | 4.72 | 1.88 |
| 59 | 4.96 | 1.84 | 5.12 | 1.64 |
| 60 | 4.92 | 1.41 | 5.08 | 1.15 |
| 61 | 4.12 | 1.62 | 4.88 | 1.33 |
| 62 | 4.68 | 1.57 | 4.52 | 1.19 |
| 63 | 4.48 | 1.58 | 4.44 | 1.45 |
| 64 | 4.28 | 1.57 | 4.08 | 1.29 |
| 65 | 5.36 | 1.98 | 5.48 | 1.64 |
| 66 | 5.36 | 2.10 | 4.92 | 1.78 |
| 67 | 4.96 | 1.99 | 5.48 | 1.92 |
| 68 | 7.08 | 1.58 | 6.36 | 1.99 |
| 69 | 6.88 | 1.36 | 6.40 | 1.63 |
| 70 | 5.24 | 1.71 | 5.32 | 1.80 |
| 71 | 4.84 | 1.91 | 5.08 | 1.71 |
| 72 | 5.92 | 1.82 | 5.00 | 1.76 |
| 73 | 6.04 | 1.72 | 5.64 | 1.75 |
| 74 | 4.68 | 1.68 | 4.88 | 1.67 |
| 75 | 5.32 | 1.89 | 5.60 | 1.96 |
| 76 | 5.16 | 1.68 | 5.64 | 1.96 |
| 77 | 6.16 | 1.91 | 6.32 | 1.82 |
| 78 | 5.36 | 1.60 | 5.24 | 1.67 |