



Citation for published version:

Emanuel, L 2012, 'Nonconscious behavioural mimicry: Examining the methods used to produce mimicry and the automatic nature of the effect', Ph.D., University of Reading.

Publication date:
2012

[Link to publication](#)

University of Bath

Alternative formats

If you require this document in an alternative format, please contact:
openaccess@bath.ac.uk

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

UNIVERSITY OF READING

Nonconscious behavioural mimicry: Examining the methods used to produce mimicry and the automatic nature of the effect

Lia L. Emanuel

School of Psychology and Clinical Language Sciences

Thesis submitted for the degree of Doctor of Philosophy in the School of Psychology and
Clinical Language Sciences

March 2012

Declaration of Original Authorship

‘I confirm that this is my own work and the use of all material from other sources has been properly and fully acknowledged’

Signature

Abstract

An individual's tendency to adjust their behaviour, to unconsciously copy the gestures of another, is known as nonconscious behavioural mimicry. Chapter One reviews the facilitative role mimicry plays in social interactions and the underlying mechanisms of behaviour matching effects. However, the conditions under which mimicry occurs are not well characterised and, although accepted to be an automatic effect, this assumption remains empirically untested. This thesis examined the methods used to elicit mimicry and further explored the mechanisms underlying the effect.

Chapter Two developed a paradigm to demonstrate mimicry relative to a suitable control condition and examined the generalisability of the effect to alternative gestures. However, mimicry was not observed. It was suggested that the target gestures were presented too overtly, and participant's awareness was responsible for not demonstrating mimicry. Toward the refinement of the paradigm, Chapter Three focused on aspects of gesture presentation, namely, duration of exposure and gesture type. Although Experiment 2 found that mimicry was not influenced by the duration of exposure to target gestures, Experiment 3 showed that mimicry can generalise to alternative, localised, gestures. Crucially, both experiments demonstrated mimicry compared to an equivalent control condition.

Chapters Four and Five examined the automaticity of mimicry, specifically the efficiency and awareness criteria. Experiments 4 and 5 did not allow for clear conclusions to be drawn about the efficiency of mimicry. However, the results from Experiment 6 provided clear evidence that lack of awareness is necessary for mimicry to occur and, when mimicry did occur, participants were unaware of their own mimicry behaviour. It was concluded that mimicry meets one of the hallmarks of automaticity; operating without awareness. The results of these experiments are discussed regarding the reliability of the mimicry effect and the methodological and theoretical implications of these findings for the mimicry literature.

Acknowledgements

I would like to first thank Laurie Butler and Natalie Hall for their insight, guidance and support from the start to the finish of this project. Their unwavering optimism and enthusiasm has been tremendously encouraging throughout, and I am fortunate to have had the opportunity to work with them. I would also like to thank Kathinka Mansfeldt for instilling in me a curiosity and interest in pursuing this path in the first place.

Many thanks to my Mom and Dad for their unending support, encouragement and understanding; the frequent phone calls and letters were especially helpful, as was the kind willingness to always ask the loaded question, “how is the research going?”. Special thanks go to James, who has kept me smiling over the past three years.

Finally, I would like to thank the members of the department and the PhD crowd who made this an enjoyable experience and kept Thursday evenings interesting. Thanks especially to Rachel Coats, Georgia Herbert and Alex Taylor for their advice and, importantly, their good sense of humour.

Table of Contents

Abstract.....	i
Acknowledgements.....	ii
List of Figures.....	viii
List of Tables.....	ix
Chapter One: Behavioural Mimicry and Imitation.....	1
1.1 General Introduction.....	1
1.1.1 Definitions of Behaviour Matching.....	1
1.1.2 The Present Thesis.....	3
1.2 Nonconscious Mimicry.....	4
1.2.1 Consequences of Nonconscious Mimicry.....	5
1.2.2 Moderators of Nonconscious Mimicry.....	9
1.2.2.3 Summary.....	15
1.2.3 Methodological Approach in Nonconscious Mimicry Research.....	15
1.2.3.1 Summary.....	18
1.3 Underlying Mechanisms of Nonconscious Mimicry.....	19
1.3.1 Automaticity.....	19
1.3.2 The Perception-Behaviour Link.....	21
1.3.3 Automaticity in Social Perception-to-Behaviour Effects.....	22
1.3.4 Summary.....	24
1.4 Imitation.....	25
1.4.1 Definition.....	26
1.4.2 Characteristic Imitation Paradigms.....	26
1.4.3 Summary.....	28
1.5 Underlying Mechanisms of Imitation.....	28
1.5.1 Neural Evidence for the Relationship Between Perception and Behaviour.....	29
1.5.2 Automaticity of Imitation.....	30
1.5.3 Theoretical Mechanisms of Imitation.....	32
1.5.4 Summary.....	34
1.6 Synthesis of the Nonconscious Mimicry Literature and Imitation Literature.....	34
1.6.1 Methodological Approach.....	36
1.6.1.1 The Use of Live and Video-Recorded Gesture Presentation.....	36

1.6.1.2 Type of Gestures Manipulated	38
1.6.1.3 Measures of Imitative and Mimicry Behaviour	39
1.6.1.4 Summary	44
1.6.2 The Underlying Mechanisms of Behaviour Matching.....	45
1.6.2.1 The Automaticity of Behaviour Matching	46
1.6.2.2 The Relationship Between Perception and Behaviour.....	47
1.6.2.3 Summary	48
1.7 Final Summary and Outline of Chapters	49
Chapter Two: Development of a Nonconscious Mimicry Paradigm	53
2.1 Introduction.....	53
2.1.1 Mimicry Paradigm	53
2.1.1.1 Live Versus Pre-Recorded Confederate.....	53
2.1.1.2 Appropriate Controls.....	55
2.1.1.3 Specific Gestures Used in Mimicry Paradigms	57
2.1.2 Development of a Mimicry Paradigm.....	58
2.2 Pilot Study.....	59
2.2.1 Development of the Stimulus Videos	61
2.3 Experiment 1a	63
2.3.1 Overview	63
2.3.2 Method	63
2.3.2.1 Participants and Design	63
2.3.2.2 Procedure	63
2.3.2.3 Dependent Measures	64
2.3.3 Results and Discussion	66
2.3.3.1 Behavioural Mimicry	66
2.3.3.2 Object Recall.....	68
2.3.3.3 Discussion.....	68
2.4 Experiment 1b.....	71
2.4.1 Overview.....	71
2.4.2 Method	71
2.4.2.1 Participants and Design	71
2.4.2.2 Procedure	71

2.4.2.3 Dependent Measures	72
2.4.3 Results and Discussion	72
2.4.3.1 Behavioural Mimicry	72
2.4.3.2 Object Recall	73
2.4.3.3 Discussion	73
2.5 General Discussion	74
Chapter Three: Nonconscious Mimicry and Gesture Presentation	78
3.1 Introduction.....	78
3.1.1 Refinement of the Mimicry Paradigm	78
3.1.2 Duration of Exposure to Target Gestures.....	82
3.2 Experiment 2.....	84
3.2.1 Overview.....	84
3.2.1.1 Development of the Stimulus Videos	84
3.2.2 Method	85
3.2.2.1 Participants and Design	85
3.2.2.2 Procedure	85
3.2.2.3 Dependent Measures	87
3.2.3 Results and Discussion	88
3.2.3.1 Behavioural Mimicry	88
3.2.3.2 Secondary Measures.....	90
3.2.3.3 Discussion	93
3.3 Experiment 3.....	96
3.3.1 Overview.....	96
3.3.1.1 Identifying New Target Gestures	97
3.3.1.2 Development of the Stimulus Videos	98
3.3.2 Method	99
3.3.2.1 Participants and Design	99
3.3.2.2 Procedure	99
3.3.2.3 Dependent Measures	99
3.3.3 Results and Discussion	100
3.3.3.1 Behavioural Mimicry	100
3.3.3.2 Secondary Measures.....	103

3.3.3.3 Discussion	105
3.4 General Discussion	106
Chapter Four: Investigating the Efficiency of Mimicry as an Automatic Behaviour	114
4.1 Introduction.....	114
4.1.1 Automaticity of Mimicry	114
4.1.2 Efficiency of Automatic Processes	116
4.2 Experiment 4.....	119
4.2.1 Overview.....	119
4.2.2 Method	120
4.2.2.1 Participants and Design	120
4.2.2.2 Procedure	120
4.2.2.3 Dependent Measures	121
4.2.3 Results and Discussion	122
4.2.3.1 Behavioural Mimicry.....	122
4.2.3.2 Secondary Measures.....	124
4.2.3.3 Discussion.....	126
4.3 Experiment 5.....	127
4.3.1 Overview.....	127
4.3.2 Method	128
4.3.2.1 Participants and Design	128
4.3.2.2 Procedure	128
4.3.2.3 Dependent Measures	129
4.3.3 Results and Discussion	129
4.3.3.1 Behavioural Mimicry	130
4.3.3.2 SAM Measure	131
4.3.3.3 Discussion	132
4.4 General Discussion	133
Chapter Five: The Role of Awareness in Mimicry as an Automatic Behaviour.....	138
5.1 Introduction.....	138
5.1.2 Awareness in Mimicry Behaviour	138
5.2 Experiment 6.....	142

5.2.1 Overview	142
5.2.2 Method	143
5.2.2.1 Participants and Design	143
5.2.2.2 Procedure	144
5.2.2.3 Dependent Measures	144
5.2.3 Results.....	145
5.2.3.1 Behavioural Mimicry	146
5.2.3.2 Perception of the Actor	147
5.2.3.3 Self-Reported Versus Actual Behaviour.....	148
5.2.3.4 SAM Measure	150
5.3 Discussion.....	151
Chapter Six: Summary and Conclusions.....	159
6.1 Introduction.....	159
6.2 Summary of Findings.....	159
6.2.1 Identifying a Paradigm to Demonstrate Mimicry Behaviour.....	159
6.2.2 The Influence of Gesture Presentation on the Mimicry Effect	160
6.2.3 The Automaticity of Mimicry Behaviour	162
6.2.4 Comparing Behavioural Results Across Chapters	163
6.3 Methodological Issues and Implications.....	166
6.3.1 The Presentation of Target Gestures	166
6.3.2 Experiment Task and Cover Story	168
6.3.3 The Measurement of Behaviour Considered Mimicry.....	169
6.4 Theoretical Implications and Directions for Future Research	173
6.4.1 How Robust is the Mimicry Effect?.....	173
6.4.2 The Underlying Mechanisms of the Mimicry Effect	175
6.4.2.1 The Automaticity of Mimicry	175
6.4.2.2 The Perception-Behaviour Link Mechanism	180
6.5 Conclusions.....	182
References.....	183
Appendices.....	197

List of Figures

Figure 2.1 Example stills from the recorded stimulus videos in Experiments 1a and 1b	62
Figure 3.1 Example video stills of face-rubbing and no gestures recorded in the Stimulus videos.....	85
Figure 3.2 Mean face-rubbing behaviour as a function of gesture video and amount of exposure +/- 1 SEM.....	90
Figure 3.3 Example video stills of cheek-rubbing and ear-touching recorded in the stimulus videos	98
Figure 3.4 Mean participant cheek-rubbing behaviour as a function of gesture video +/- 1 SEM	101
Figure 3.5 Mean participant ear-touching behaviour as a function of gesture video +/- 1 SEM	102
Figure 4.1 Marginal means of face-rubbing behaviour as a function of gesture video seen and cognitive load +/- 1 SEM	123
Figure 4.2 Marginal means of face-rubbing behaviour in the low cognitive load group as a function of gesture condition and time across the experiment.....	124
Figure 4.3 Marginal means of face-rubbing behaviour as a function of gesture video seen and cognitive load +/- 1 SEM	131
Figure 5.1 Marginal means of face-rubbing behaviour as a function of condition +/- 1 SEM	147
Figure 5.2 Mean self-reported and expressed face-rubbing behaviour as a function of condition +/- 1 SEM	149
Figure 6.1 Mean participant behaviour expressed (+/- 1 SEM) as a function of gesture absent and gesture present in the stimulus video across Experiments 1b-6	165

List of Tables

Table 1.1 Measures of Mimicry Behaviour	17
Table 2.1 Mean Ratings for the Regularity the Piloted Gesture were Performed (and the Composite Measure of Overall Face-rubbing)	62
Table 2.2 Mean Frequency per Minute of Gesturing as a Function of Gesture Condition.....	68
Table 2.3 Mean Participant Behaviour as a Function of Gesture Condition.....	73
Table 3.1 Mean Ratings on the SAM Pleasure and Arousal Scales as a Function of Time, Gesture in Video and Duration of Exposure	92
Table 3.2 Mean Ratings on the SAM Pleasure and Arousal Scales as a Function of Time and Gesture Condition.....	104
Table 4.1 Mean Ratings on the SAM Pleasure and Arousal Scales as a Function of Time, Gesture in Video and Cognitive Load	126
Table 4.2 Mean Ratings on the SAM Pleasure and Arousal Scales as a Function of Time, Gesture in Video and Cognitive Load	132
Table 5.1 Mean Ratings on the SAM Pleasure and Arousal Scales as a Function of Time and Condition.....	151

Chapter One:

Behavioural Mimicry and Imitation

1.1 General Introduction

Humans engage in social interactions every day, whether with strangers or well-known friends and family, and this social contact shapes the way we perceive, think and act in our environment. In both verbal and non-verbal exchanges, there is arguably a strong tendency for people to behave in a similar fashion to those around them, to imitate or mimic (Chartrand & Dalton, 2009). While the concept of individuals mimicking other people's behaviour is not new (James, 1890; LaFrance, 1979), a renewal of interest in the area has led to a body of research exploring the subtle and often unconscious manner in which people copy the gestures and behaviour of others with whom they are interacting (Castelli, Pavan, Ferrari, & Kashima, 2009; Chartrand & Bargh, 1999; Cheng & Chartrand, 2003; Ferguson & Bargh, 2004; Gueguen & Martin, 2009; Heyes, 2001; Karremans & Verwijmeren, 2008; Lakin & Chartrand, 2003; Lakin, Chartrand, & Arkin, 2008; Parrill & Kimbara, 2006; van Baaren, Horgan, Chartrand, & Dijkmans, 2004a; van Baaren & Chartrand, 2009; van Swol, 2003; Yabar, Johnston, Miles, & Peace, 2006). The copying of gestures and behaviour has been observed in phenomena employing a variety of definitions, as outlined below.

1.1.1 Definitions of Behaviour Matching

The act of mimicking another individual has been observed in a variety of behaviours including imitating facial expressions (Dimberg, Thunberg, & Elmehed, 2000) and non-verbal mannerisms such as posture (LaFrance, 1985) and gestures (Chartrand & Bargh, 1999). Such mimicry is defined as a perceiver copying or changing their body movement to match that of another person (Brass & Heyes, 2005). The term 'mimicry' has been used widely to describe the type of behaviour matching defined above and is often used interchangeably with a variety of terms (e.g., automatic imitation, motor mimicry, behavioural mirroring and spontaneous behaviour matching). However, these terms fall into two distinct categories; consciously guided action leading to mimicry effects and nonconscious mimicry effects.

Research on instructed action showing mimicry tendencies often employs the terms *motor mimicry* (e.g., Spengler, von Cramon, & Brass, 2010) and to a greater extent *imitation* (Bertenthal, Longo, & Kosobud, 2006; Heyes, 2001; Iacoboni, 2009; Leighton, Bird, & Heyes, 2010; Press, Bird, Flach, & Heyes, 2005; Rizzolatti & Craighero, 2004; Wilson, 2001) to describe consciously controlled, goal-oriented, matching and non-matching behaviour movements. In this type of imitation research, a stimulus-response compatibility paradigm is typically employed. Specifically, participants are instructed to perform a pre-specified movement, such as opening their hand, when presented with a compatible action (e.g., a open hand) or an incompatible action (e.g., a closed hand). Thus, the presentation of the action signifies when participants should perform the hand movement, not what movement to make. By measuring participants' reaction times, executed responses to the action cues are facilitated when that hand cue is congruent. Conversely, there is an interference effect in the executed response when individuals make incompatible movements, such as seeing a closed hand action when instructed to perform an open hand movement (Brass, Bekkerin, Wohlschlagel, & Prinz, 2000; Brass, Bekkerin, & Prinz, 2001; Leighton, Bird, Orsini, & Heyes, 2010). Notably, in this type of paradigm the individual is conscious of the initial action, such as opening or closing ones hand, but the facilitation or interference effects of the observed action cues on their own behaviour is not intentional. These findings suggest perception of an action has a strong influence on the execution of an action and individuals can execute compatible or imitative movements more readily than incompatible or non-imitative movements.

Terms such as *behaviour mirroring* (LaFrance, 1985) and, more recently, *nonconscious behavioural mimicry* (Chartrand & Bargh, 1999) have been applied to describe mimicry effects that occur unconsciously. This type of mimicry behaviour characterises the unintentional behaviour matching that often occurs without the conscious awareness of the individual expressing the mimicry behaviour, or the individual being mimicked (Chartrand & van Baaren, 2009). Nonconscious behavioural mimicry of non-verbal gestures was initially defined and demonstrated in Chartrand and Bargh's (1999) seminal paper. The authors introduced the term "chameleon effect" to describe an individual's tendency to adjust their behaviour in line with that of others and to unconsciously mimic the gestures of an interaction partner. Specifically, they asked participants to complete a photo-description task with live confederates previously unknown to the participant. In one session, a confederate either shook their foot or rubbed their face while taking turns with

the participant to describe a set of photographs. In the second session a different confederate performed the gesture that the previous confederate had not, such that participants were exposed to both face-rubbing and foot-shaking. Both sessions were videotaped to measure the amount of face-rubbing and foot-shaking behaviour that was expressed by the participants.

The authors found that participants changed their behaviour as the behaviour of their interaction partner changed. Participants rubbed their face more with a face-rubbing confederate than with a foot-shaking confederate and, conversely, shook their foot marginally more with a foot-shaking confederate than with a face-rubbing confederate. Importantly, in a funnelled debrief, participants were asked if they noticed anything about the confederate's behaviour, if they were aware of the changes in gestures expressed throughout the interaction and whether they believed the cover story of the photo-description task. Largely, participants were unaware of the confederate's behaviour and their own mimicry of the gestures, as well as of the true aim of the study. Chartrand and Bargh (1999) concluded that mimicry could occur without intention or awareness and, thus, could occur unconsciously.

1.1.2 The Present Thesis

At the outset, it is important to note that the overall focus of the current chapter, and this thesis generally, is on nonconscious behavioural mimicry. However, I will also draw on the conscious imitation literature when discussing the theoretical underpinnings of mimicry and various methodological issues, for reasons I expand upon below. The reader should also be aware that there is an extensive literature exploring mimicry and imitation of facial expressions, such as an individual's tendency to smile when observing another individual smile (Hess & Blairy, 2001). This tendency is held to be closely tied with empathy and emotional processing (Hatfield, Cacioppo, & Rapson, 1993; Niedenthal, Brauer, Halberstadt, & Innes-Ker, 2001). Such effects may reflect the operation of automatic affective processes rather than strictly automatic motor processes (Dimberg, 1997; Iacoboni, 2005; Moody, McIntosh, Mann, & Weisser, 2007). This has implications with regards to the underlying mechanisms driving mimicry/imitation of facial expression as compared to non-affective mannerisms and gestures. For this reason, the body of research

concerning mimicry or imitation of facial expressions and its close relationship with emotion and empathy are beyond the scope of this thesis.

Although nonconscious mimicry and imitation effects share many similar qualities in terms of expressing observed motor behaviour, research on these two effects has diverged into relatively distinct bodies of literature. Research on nonconscious mimicry has primarily focused on the social implications of behaviour matching to gain a better understanding as to why this effect occurs in social interactions. Conversely, the empirical work on imitation effects has provided further insight into the mechanisms supporting behaviour matching effects. Nonconscious mimicry forms the basis of the empirical work reported in this thesis. Thus, this chapter will consider these two distinct forms of behaviour matching, by first examining how nonconscious mimicry has been previously demonstrated and the effect that nonconscious mimicry has on social interactions. After considering evidence as to why individuals engage in mimicry behaviour, the present review will turn to the theoretical mechanisms proposed to underlie the nonconscious mimicry effect. The nonconscious mimicry literature is limited with respect to direct evidence for the underlying mechanisms responsible for behaviour matching effects; therefore I consider mechanistic evidence from the imitation literature. The paradigms used to demonstrate imitation effects will be reviewed, alongside the theoretical models that provide a framework for the mechanisms involved in imitative behaviour. Finally, the findings on nonconscious mimicry and imitation effects will be compared and contrasted specifically with regard to how the approaches and evidence accrued in the imitation literature may better inform the research undertaken in this thesis examining nonconscious mimicry.

1.2 Nonconscious Mimicry

Research on nonconscious mimicry has typically taken one of two approaches to investigate this phenomenon. One method has been to consider the consequences for the individual that arise from being mimicked. This approach has identified several positive social consequences that participants experience after being mimicked (e.g., Bailenson & Yee, 2005; Lakin, Jefferis, Cheng, & Chartrand, 2003; Sanchez-Burks, Bartel, & Blount, 2009; van Baaren, Holland, Steenaert, & van Knippenberg, 2003a; van Baaren, Janssen, Chartrand, & Dijksterhuis, 2009). Generally, in this type of design, one group of participants have their gestures, mannerisms and posture mimicked by a confederate or

virtual agent, whereas another group are not mimicked. All participants then complete a different task that measures social or cognitive factors that are proposed to be influenced by being mimicked or not.

A second approach has been to measure a participant's tendency to mimic a target gesture(s) of another person with whom they are interacting. This method had been used to test how moderating factors increases or decreases the amount of mimicry expressed within an interaction task where target gestures are always present for the participant to mimic. A number of social factors and, to lesser extent, cognitive factors, have been shown to moderate an individual's tendency to express nonconscious mimicry behaviour (e.g., Cheng & Chartrand, 2003; Lakin & Chartrand, 2003; van Baaren, Maddux, Chartrand, de Bouter, & van Knippenberg, 2003b).

Both methods of examining the mimicry effect typically involve an interaction task, such as describing photographs with a confederate (e.g., Chartrand & Bargh, 1999), or informal interviews with a confederate (e.g., Ashton-James & Chartrand, 2009). This has allowed researchers to present target gestures or to mimic the gestures of participants in an unobtrusive manner. In addition to this, retrospective awareness checks are typically administered to probe for awareness. These include questions pertaining to participants' awareness of a confederate's behaviour or of the true aim of the experiment (Chartrand & Bargh, 1999; Bargh & Chartrand, 2000). These procedures have been adopted in an effort to ensure that the behavioural mimicry effects measured were indeed unconscious. The following sections will review the research evidence from both of these approaches considering nonconscious behavioural mimicry.

1.2.1 Consequences of Nonconscious Mimicry

It has been suggested that mimicry behaviour plays an integral role in social interactions (Chartrand & van Baaren, 2009). Specifically, mimicry behaviour has been shown to facilitate the strengthening of social bonds, create rapport and affiliation and promote prosocial behaviour towards another (e.g., Ashton-James, van Baaren, Chartrand, Decety, & Karremans, 2007; Chartrand & Bargh, 1999; Lakin & Chartrand, 2003; van Baaren, Holland, Kawakami, & van Knippenberg, 2004b). These socially functional consequences of nonconscious mimicry have been shown to not only affect the interaction group, or

dyad, in which mimicry occurs, but also to influence a number of social and cognitive factors at the individual level.

Liking and Social Rapport

Chartrand and Bargh (study 2, 1999) found that when participants were mimicked by a confederate they reported liking the confederate more than those who had not been mimicked. The influence of being mimicked on reports of liking also appears to extend beyond the traditional dyad interaction. Bailenson and Yee (2005), for instance, found participants reported liking a virtual agent that mimicked their mannerisms more than when not being mimicked, and increased feelings of liking appear to transfer from the mimicker to novel products (e.g., a new sports drink and biscuit snack) when mimicked during forming an impression of the items (Tanner, Ferraro, Chartrand, Bettman, & van Baaren, 2008).

Sanchez-Burks, Bartel and Blount (2009) extended the finding that mimicry facilitates smoother interactions (Chartrand & Bargh, 1999) and examined the effects of being mimicked in a business interview task. While employees were under the impression that they were taking part in a job evaluation, Sanchez-Burks et al. found that those who were mimicked during an interview later rated it as having gone more smoothly (and reported lower levels of state anxiety), than those who were not mimicked. Building on these findings, Dalton, Chartrand and Finkel (2010) suggest that being mimicked in an interaction may prevent an individual from expending additional resources in an effort to maintain a coordinated interaction. The authors found that participants who were mimicked by a confederate performed better on tasks measuring resource depletion, such as showing less Stroop interference and lower error rates in a resource depleting dual-signal detection task, compared to those who were 'anti-mimicked' (e.g., if the participant slouched the confederate sat with a straight posture).

Although this suggests that mimicry might be implemented as an efficient tool to facilitate coordinated social interactions, the use of an 'anti-mimicked' manipulation to create an uncoordinated interaction is a departure from the typically employed not mimicked group (i.e., the confederate displays a neutral body position throughout the interaction). It is currently unclear how comparable this 'anti-mimicry' behaviour, displaying the opposite

behaviour to that of the participant, is to mimicry behaviour. Nonetheless, the evidence discussed suggests that being mimicked can subtly shape how individuals perceive an interaction, such as reporting greater feelings of liking and rapport as well as experiencing more coordinated interactions. In addition, the experience of increased liking appears to extend to other agents and objects involved in the interaction where mimicry occurred. With these findings in mind, researchers have considered whether these positive consequences can be manifested in terms of observable prosocial behaviour.

Prosocial Behaviour

In a controlled study outside of the laboratory, van Baaren et al. (2003a) found that waitresses who verbally mimicked restaurant customers received bigger tips compared to instances where customers were not verbally mimicked, even when taking into account the average tips received prior to the study. This led the authors to suggest that mimicry may have the potential to encourage prosocial behaviour. To follow up these findings, van Baaren et al. (2004b) employed the more traditional photo-description task and found that participants who were mimicked showed significantly more instances of helping the confederate who had mimicked them by picking up several 'accidentally' dropped pens, relative to those who had not been mimicked.

Furthermore, van Baaren and colleagues (2004b) found prosocial behaviour extended beyond helping the individual who mimicked the participant. Individuals who had been mimicked subsequently displayed more instances of helping behaviour to a new confederate not involved in the prior interaction when mimicry occurred. The finding that being mimicked increases prosocial behaviour has been replicated using different measures of prosocial behaviour. These include volunteering time to help an unknown colleague (Ashton-James et al., 2007), donating more money to charity (van Baaren et al., 2004b), and reaching more cooperative deals in negotiation tasks (Maddux, Mullen, & Galinsky, 2008). This would suggest that it is a robust finding. To further understand how being mimicked causes these positive social consequences to occur, research examined how being mimicked influences the way in which an individual perceives and processes social information regarding the self and others.

Self-Construal

Ashton-James et al. (2007) found across three studies that when participants were mimicked they exhibited an interdependent self-construal; that is, they defined themselves in relation to others. Conversely, those who were not mimicked showed independent self-construal identity attributes, defining themselves as distinctly apart from others. The manner with which individuals perceive and process information can also be measured by cognitive style, which is held to be closely related to self-construal (Kuhnen, Hannover, & Schubert, 2001). Ashton-James and Chartrand (2009) found that when participants were mimicked they performed better on tasks requiring them to perceive and process contextual cues in a global interconnected manner (e.g., field-dependent cognitive style). Conversely, those who were not mimicked performed better on tasks requiring perception and processing of cues in a localised disconnect manner (field-independent cognitive style). The discussed evidence suggests that being mimicked results in temporarily showing interdependent self-construal attributes as well as field-dependent cognitive style, both of which involve the tendency to perceive people and objects in an interconnected manner.

Sanchez-Burks and colleagues (2009) found similar results by examining how being mimicked affected individuals who differ culturally on the chronic reliance of an other-oriented self-construal (e.g., interdependent self-construal) or in a self-oriented self-construal (e.g., independent self-construal). The study compared a group of U.S. Latinos, who traditionally exhibit chronic interdependent self-construal orientation and a group of U.S. Anglos, who typically show chronic independent self-construal orientation. The chronically other-oriented U.S. Latino group reported greater levels of anxiety when they were not mimicked in a mock interview and, conversely, were rated as performing better in a workplace performance evaluation (e.g., motivation, assertiveness, interpersonal skills, and overall impression) by experienced human resource executives when they were mimicked by the interviewer. In contrast, the chronically self-oriented U.S. Anglo group showed no differences in reported anxiety level or performance evaluation, regardless of being mimicked or not (Sanchez-Burks et al., 2009).

The discussed findings suggest that being mimicked can temporarily result in participants perceiving themselves in relation to those around them and facilitating a processing style that relies on interconnected contextual cues. Moreover, individuals who are chronically

predisposed to identify themselves in relation to others appear to benefit the most when they are mimicked, as opposed to those who chronically identify themselves in a self-oriented manner. Together, the results suggest that this chronic and temporary reliance on an interconnected orientation possibly contributes to experiencing the positive social consequences, such as feelings of liking and rapport (Chartrand & Bargh, 1999; Lakin & Chartrand, 2003) when an individual is mimicked in an interaction.

This section reviewed the positive social consequences for the dyad which occurs in the presence of mimicry, such as greater feelings of liking (Bailenson & Yee, 2005; Chartrand & Bargh, 1999), rapport (Sanchez-Burks et al., 2009) and greater instances of prosocial behaviour (Maddux et al., 2008; van Baaren et al., 2004b). Being mimicked also appears to influence how an individual perceives and processes social information within an interaction (Ashton-James et al., 2007; Ashton-James & Chartrand, 2009; Sanchez-Burks et al., 2009). The following section will review the second approach the mimicry literature has taken to investigate this effect, namely, how social and cognitive factors can influence the tendency to mimic the target gesture of another person.

1.2.2 Moderators of Nonconscious Mimicry

The variety of positive consequences that individuals experience when mimicked underscores the importance and beneficial influence of such a subtle social behaviour. However, individuals do not appear to express mimicry indiscriminately. Researchers have also identified a number of factors which appear to influence the degree to which an individual mimics the behaviour of another. In many cases, the consequences or outcomes of being mimicked discussed above, such as liking (Chartrand & Bargh, 1999), self-construal (Ashton-James et al. 2007) and cognitive style (Ashton-James & Chartrand, 2009) have also been shown to moderate the amount of mimicry an individual expresses (e.g., Cheng & Chartrand, 2003; Lakin & Chartrand, 2003; van Baaren et al., 2004a). The following section considers each of these moderating factors in turn.

Liking and Affiliation

Building on the finding that being mimicked by a confederate improved liking and rapport of that confederate (Chartrand & Bargh, 1999; Lakin, Jefferis, Cheng, & Chartrand, 2003;

Sanchez-Burks et al., 2009) there is also evidence to suggest that expressing mimicry behaviour may have similar effects. Lakin and Chartrand (2003) demonstrated that participants who spent a greater amount of time mimicking the foot-shaking behaviour of a confederate later rated liking that confederate more than participants who spent less time mimicking the confederate. Interestingly, the confederate also reported higher ratings of liking for participants who spent a greater amount of time mimicking their own foot-shaking behaviour. This evidence has been used to suggest that the relationship between liking and mimicry is bi-directional. It is benefiting both the individual who is mimicked and the individual who is doing the mimicking.

This finding has led researchers to examine the possibility that mimicry behaviour could be used as a tool to achieve a positive outcome within an interaction. The goal to affiliate, to pursue rapport and social closeness (Lakin & Chartrand, 2003), has been one of the more extensively investigated social factors that influences mimicry behaviour within the literature. As a result, a number of innovative experiments have examined different aspects of how the goal to affiliate influences the degree to which individuals express mimicry behaviour. Lakin and Chartrand (2003) primed the concept of the goal to affiliate, either by subliminally presenting words related to affiliation (e.g., *affiliate*, *together*, and *friend*) or by explicitly informing participants that it was important that they work well with the confederate on a highly cooperative based task. The authors found that participants primed (both implicitly and explicitly) with the goal to affiliate showed a greater tendency to unconsciously mimic the face-rubbing behaviour of a confederate presented by video, compared to those who received no such goal. Cheng and Chartrand (2003) found similar results of the effect of affiliation on mimicry behaviour among individuals they proposed would be more pre-disposed to pursue affiliation cues. The authors found that participants classified as high self-monitors (e.g., highly motivated to control their projected self-image) mimicked their interaction partner to a greater extent when the goal to affiliate was more salient, such as interacting with a peer as opposed to a younger or older interaction partner. Conversely, participants classified as low self-monitors did not appear to use mimicry behaviour to pursue affiliation, showing similar levels of mimicking the behaviour of a peer and of non-peers (Cheng & Chartrand, 2003).

Lakin and Chartrand (2003) also investigated affiliation goal pursuit after an initial failure to affiliate. Using the same subliminal priming task described in the authors' previous

study, participants subsequently completed an online interview task in which their interaction partner was either friendly (succeeded in affiliation goal) or unfriendly (failed in affiliation goal). Given that goal-priming effects generally persist until the goal is attained (Forster, Liberman, & Friedman, 2007), it was expected that those who did not achieve the affiliation goal would continue to try to affiliate. When participants subsequently interacted with a live confederate who continually performed foot-shaking behaviour, those primed with the goal to affiliate spent more time mimicking the confederate's foot-shaking behaviour when they failed in the first online interaction compared to those who succeeded. The difference in participant mimicry behaviour when they were previously successful or not successful in attaining the goal to affiliate suggests that mimicry behaviour may be used as one means of achieving the goal to affiliate.

Similar effects on the tendency of participants to mimic a confederate have been found when employing other contextual cues within social interactions to activate the goal to affiliate. For instance, social exclusion (Lakin et al., study 1, 2008) and participants being led to believe they were responsible for a negative interaction outcome (Martin, Gueguen, & Fisher-Lokou, 2010) has been demonstrated to subsequently result in greater instances of mimicking the face-rubbing or foot-shaking behaviour of a confederate compared to those who were not excluded or blamed. Consequently, these studies support the idea that cues to affiliate —both primed and as a result of the interaction context —can lead to an increased tendency to mimic the behaviour of an interaction partner to achieve an affiliation goal. Nonconscious mimicry research has also examined factors about the type of person participants interact with and how this may influence the cues that trigger the goal to affiliate.

Similarity

Individuals show a greater tendency to mimic the behaviour of an interaction partner if they share the same opinion (van Swol, 2003), share a similar name or subject of study (Gueguen & Martin, 2009) or share a similar understanding and ideas on a discussed topic (Castelli et al., 2009). In contrast, individuals show decreased levels of mimicking another person who represents a negative or stigmatised group, viewing that person as dissimilar to how they perceive themselves' (Johnston, 2002). In other words, individuals show a

tendency to unconsciously mimic someone they see as similar to themselves, or someone perceived to be an ingroup member.

In Yabar, Johnston, Miles and Peace (2006) investigation of the effect of group membership on behavioural mimicry, the authors found in a pilot study that a stereotypically portrayed Christian confederate was perceived as an outgroup member and a stereotypically non-Christian confederate was perceived as an ingroup member within their target population. In a subsequent study, participants completed a video based photo-description task where both the identified ingroup and outgroup confederate were shown continually performing face-rubbing behaviour. Yabar and colleagues found participants spent a greater percentage of time mimicking the face-rubbing behaviour of the ingroup member, compared to the time spent mimicking the outgroup member. Furthermore, from a one minute baseline measure of face-rubbing behaviour prior to the photo-description tasks, the authors found that participants actually showed a reduction of face-rubbing behaviour when they were shown the outgroup confederate, relative to their baseline behaviour.

The results suggest that individuals expressed greater levels of mimicry behaviour when interacting with someone that they perceived to be similar to themselves, and that mimicry of a target behaviour performed by an outgroup member maybe inhibited altogether, rather than expressed at lower levels. This finding corroborates the evidence that contextual social cues triggering the goal to affiliate leads to greater instances of mimicry behaviour (Lakin & Chartrand, 2003; Lakin et al., 2008). Specifically, it would be expected that the goal to affiliate with an ingroup member would be more likely pursued compared to an outgroup member. Lakin et al.(2008) provided evidence for this proposition showing that when participants were excluded by an ingroup member, in this case classified by gender, they mimicked a different ingroup confederate to a greater extent than an outgroup confederate in a second unrelated task. This targeted mimicking of a particular group member did not occur for participants excluded by an outgroup confederate; mimicking both the ingroup and outgroup confederate similarly. Considering previous evidence indicating that experiencing a negative interaction seems to activate the goal to affiliate (Lakin et al., study 1, 2008; Martin et al., 2010), it also appears that nonconscious mimicry behaviour may be used as a tool to reaffirm group ties and attempt to re-establish affiliation following exclusion from an ingroup member.

The way in which an interaction partner is perceived, such as being similar or different to oneself, seems to influence the extent to which mimicry behaviour is expressed. However, individual differences of the mimicker, rather than mimicked person (i.e., confederate) have also been shown to influence mimicry behaviour. Namely, factors such as anxiety, mood, cognitive style and self-construal have also been demonstrated to moderate mimicry behaviour.

Anxiety and Mood

The level of an individual's anxiety, particularly social anxiety, appears to moderate the degree with which participants mimic the behaviour of another (Vrijnsen, Lange, Becker, & Rinck, 2010). Those categorised as chronically high in social anxiety expressed less instances of nonconscious mimicry behaviour than those who were low in social anxiety. The authors proposed that the decreased expression of nonconscious behavioural mimicry may relate to decreased feeling of rapport and interactions going smoothly (e.g., Lakin & Chartrand, 2003), thus contributing to feelings of social anxiety.

Investigating a similar intrapersonal factor, Van Baaren, Fockenberg, Holland, Janssen and van Knippenberg (2006) found an effect of mood moderating nonconscious mimicry, particularly by examining positive and negative affect. Across two studies, the researchers found that both positive self-reported affect and directly manipulated positive affect was linked to a higher incidence of nonconscious mimicry. Those primed with positive affect (manipulated by a comedic video clip prior to the mimicry task) expressed more instances of mimicking the pen-playing behaviour of a confederate presented by video compared to watching another confederate adopting a neutral body position. No such mimicry effects occurred for those who were primed with negative affect (manipulated by a sad drama video clip). These findings led the researchers to tentatively suggest that affective state may influence how information about the interaction is processed. Specifically, that positive affect prompts a more global processing style than a negative affective state, and this manner of information processing may influence mimicry behaviour (van Baaren et al., 2006). The following section turns to these types of processing style and evidence for its influence on nonconscious mimicry.

Cognitive Style

The relationship between cognitive style and mimicry behaviour appears to be bi-directional. As noted above, being mimicked seems to lead to adopting a field-dependent cognitive style (Ashton-James & Chartrand, 2009) and individuals who are both chronically field-dependent, as well as task induced field-dependent, show a tendency to spend a greater portion of the time engaging in mimicry behaviour than field-independent individuals (van Baaren et al., 2004a). The manner in which field-dependent individuals perceived and processed information in a more global, interconnected manner, may lend itself to perceiving an interaction partner to be more similar to oneself, which would account for the increased tendency to mimic (Lakin et al., 2008 ; van Swol, 2003; Yabar et al., 2006). An alternative possibility may be that field-dependent individuals are more attentive to contextual cues in the interaction, such as subtle cues signifying liking, friendliness, cues to affiliate or even the general behaviour that their interaction partner is displaying. Research that has examined the influence of self-construal on mimicry behaviour, discussed below, seems to support the former account.

Self-Construal

Van Baaren and colleagues (2003b) found that by temporarily priming independent self-construal using a sentence completion task (e.g., using words such as *I*, *me* and *mine*) less expression of mimicry behaviour resulted, compared to those primed with interdependent (other-oriented) self-construal. In a follow up study, the authors found similar results by examining the influence of chronic independent and interdependent self-construal, based on cultural factors, on mimicry behaviour. Specifically, Japanese individuals, who show strong tendencies toward chronic interdependent self-construal, mimicked a confederate's behaviour significantly more than American individuals, who tend to chronically rely on an independent self-construal.

The evidence provided by van Baaren and colleagues (2003b) suggests that perceiving one's self in relation to others, rather than independently from others, leads to increased mimicry expression. Importantly, being mimicked has also shown to temporarily shift an individual's self-construal to a more other orientation (Ashton-James et al., 2007) and those who are chronically other-oriented seem to benefit most when mimicked (Sanchez-

Burks et al., 2000). This evidence suggests that the relationship between mimicry and self-construal is bi-directional; mimicry increases perceptions of interdependence and interdependence increases mimicry behaviour.

1.2.2.3 Summary

The empirical work discussed above has led to the identification of a number of beneficial consequences that individuals experience when mimicry occurs in an interaction, as well as various social and individual factors that influence when and who a perceiver will mimic. These findings suggest that nonconscious mimicry is a pervasive feature in the social interactions in which individuals engage every day. The next section will review the methodological approaches adopted in the mimicry literature, highlighting a wide range of methods employed across studies.

1.2.3 Methodological Approach in Nonconscious Mimicry Research

Experiment Tasks in which Mimicry is Measured

Nonconscious mimicry research has employed a number of different task scenarios to create a mock interaction. These have included photo-description tasks (e.g., Ashton-James et al., 2007; Chartrand & Bargh, 1999; Yabar et al., 2006), informal interviews (e.g., Ashton-James & Chartrand, 2009; Lakin & Chartrand, 2003), pair reading tasks (Karremans & Verwijmeren, 2008; van Baaren et al., 2003b), memory tasks of an individual's clerical jobs around a room (Lakin & Chartrand, 2003; van Baaren et al., 2004b; van Baaren, et al., 2006) and judgment based tasks such as impression formation (Bailenson & Yee, 2005; van Baaren et al., 2003b; Vrijssen et al., 2009; 2010).

The majority of these tasks employed in the mimicry literature have involved participants interacting face-to-face with a live confederate (Ashton-James et al., 2007; Chartrand & Bargh, 1999; Castelli et al., 2009; Cheng & Chartrand, 2003; Finkel et al., 2006; Johnston, 2002; Lakin et al., 2008; Sanchez-Burks et al., 2009; van Baaren et al., 2003b; van Baaren et al., 2004b; van Swol, 2003). However, similar effects have been demonstrated using a video based presentation of an actor or virtual agent. For example, participants tend to rate a virtual agent as being more likable and persuasive as a consequence of being mimicked

(Bailenson & Yee 2005; Vrijnsen et al., 2009) and mimic the behaviour of an actor presented via a video clip (Lakin & Chartrand, study 1, 2003; van Baaren et al., study 1, 2004a; 2006; Vrijnsen et al., 2010; Yabar et al., 2006).

Mimicry Measures

When examining the amount of mimicry behaviour a participant expresses, the time spent on the tasks discussed above is typically estimated and averaged across participants (e.g., Chartrand & Bargh, 1999; van Swol, 2003). This estimate has varied widely across the literature, with tasks in which mimicry was measured lasting between three minutes (Vrijnsen et al., 2010) and twenty minutes (Chartrand & Bargh, 1999), or simply not reported (Cheng & Chartrand, 2003; Lakin et al., 2008; van Baaren et al., 2004a). In addition, the overall frequency with which the target gestures are presented to participants within these tasks are typically stated as “continuous” throughout a task (Cheng & Chartrand, 2003; Lakin & Chartrand, 2003; Lakin, Chartrand, & Arkin, 2008), especially when a live confederate is used to present the target gestures rather than the use of video stimulus. To further summarise the methods and designs used within the mimicry literature, all of the mimicry studies to date that measure the amount of mimicry expressed by participants are listed in Table 1.1 below. The table details how each experiment within studies have manipulated and measured target behaviour.

As Table 1.1 highlights, nonconscious mimicry has primarily been demonstrated by employing face-rubbing and foot-shaking behaviour. Although some researchers have employed other mannerisms, such as playing with a pen (Stel et al., 2009; van Baaren et al., study 2, 2006; van Baaren et al., study 2, 2003b) and eating behaviour (Johnston, 2002), such behaviours have been far more rarely studied. While face-rubbing and foot-shaking have been the two predominantly manipulated target gestures, there has been a range of variability across the literature with regard to what aspects of these two behaviours are measured as mimicry. As shown in Table 1.1, the frequency (e.g., Gueguen & Martin, 2009), duration (e.g., Lakin et al., 2008), and different types of index scores; such as frequency per minute (Chartrand & Bargh, 1999), percentage of time spent gesturing (Lakin & Chartrand, 2003; Yabar et al., 2006) and the combined frequency of two (van Baaren et al., 2003b) or three (van Baaren et al., 2004a) different gestures have been used to measure participants mimicry of a target gesture.

Table 1.1 Measures of Mimicry Behaviour

Experiments	Target gesture presented					Pre-experiment baseline	Manipulation of target gesture in study				Experiment comparison (IV)				Measure of participants' behaviour (DV)
	face-rubbing	foot-shaking	face-rubbing & foot-shaking		other		all participants exposed to target gesture(s)	w-p comparison between two different gestures	w-p comparison of one gesture vs. no gestures	b-p moderating factor	w-p moderating factor	mixed design moderating factors	w-p gesture type & moderating factor	w-p gesture type	
Lakin et al, (2008) E1		x				x	x		x						duration (seconds per min.)
Lakin et al., (2008) E2		x				x	x		x						duration (seconds per min.)
Lakin & Chartrand, (2003) E2		x				x	x		x						duration (seconds per min.)
Cheng & Chartrand, (2003) E1		x				x	x		x						duration (seconds per min.)
Cheng & Chartrand, (2003) E2	x					x	x		x						duration (seconds per min.)
van Baaren et al.(2004a), E3	x					x	x				x				duration (seconds per min.)
Yabar et al., (2006)	x					x	x			x					% of time spent expressing gesture
Lakin & Chartrand, (2003) E1	x						x		x						duration (seconds per min.)
Gueguen & Martin (2009) E1	x						x		x						total frequency
Gueguen & Martin (2009) E2	x						x		x						total frequency
Martin et al., (2010)	x						x		x						total frequency
van Baaren et al. (2006) E1	x						x		x						total frequency and total duration
van Baaren et al. (2004a) E2	x						x			x					frequency per min.
Karremans et al. (2008) E1	x						x		x						total frequency
Karremans et al. (2008) E2	x						x		x						total frequency
Karremans et al. (2008) E3	x						x		x						total frequency
Chartrand & Bargh (1999) E3			x				x		x						frequency per min.
van Baaren et al. (2004a) E1				x			x		x						index score* (seconds per min.)
Castelli et al. (2009) E2			x				x		x						total frequency
Castelli et al. (2009) E1			x				x		x						total frequency
Vijrisen et al. (2010) E1				x			x		x						total frequency
van Baaren et al. (2003b) E2				x			x		x						frequency per min.
van Swol (2003)				x		x							x		frequency per min.
van Baaren et al. (2003b) E1			x					x				x			index score* (frequency per min)
Chartrand & Bargh (1999) E1			x			x		x					x		frequency per min.
van Baaren et al. (2006) E2				x				x				x			total frequency

Note E = experiment; w-p = within-participant design; b-p = between-participant design; IV = independent variable; DV = dependent variable; * = index of multiple gestures created by averaging or summing participant behaviour

Table 1.1 also indicates the two primary methods used to compare changes in participants' behaviour within a mimicry paradigm. The first is the use of a one minute pre-experiment baseline measure taken prior to the task in which mimicry behaviour is measured. This measure is then generally used as a type of control, either as a covariate variable (Cheng & Chartrand, 2003; Lakin et al., 2008; van Baaren et al., 2003a) or used to create an index score of behaviour (Yabar et al., 2006), to account for individual differences of gesture expression prior to any exposure to a target gesture. However, this baseline measure has only been implemented in a handful of experiments and in some cases sporadically within multi-study papers (e.g., Chartrand & Bargh, 1999; Lakin & Chartrand, 2003; van Baaren et al., 2004a).

The second method of comparing changes in participant behaviour is by introducing a moderating factor. As shown in Table 1.1 in the "IV" column, participants are first either primed with a moderating factor of interest, such as an affiliation goal (Lakin & Chartrand, 2003), a type of cognitive style (van Baaren et al., 2003b) or placed in a control condition where the moderating factor is not present. Following this, all participants are exposed to the same target gestures, and it is the participants' expression of those target gestures which is taken as a measure of mimicry. This type of design has an experimentally similar control condition for the social or cognitive moderating variables. However, unlike the methodology adopted in examining the consequences of being mimicked, where half of the participants are mimicked by a confederate or virtual agent, and the other half are not mimicked (e.g., Ashton-James & Chartrand, 2009; Bailenson & Yee, 2005; Chartrand & Bargh, studies 2 & 3, 1999; Sanchez-Burks et al., 2009; van Baaren et al., 2003a; van Baaren et al., 2004b), there is no behavioural or mimicry control condition. There are, however, a few exceptions to the use of behavioural control condition, namely the last four experiments listed in Table 1.1. which will be discussed in full later in this chapter.

1.2.3.1 Summary

On the one hand, the number of varied approaches in examining nonconscious mimicry suggests the effect is relatively robust, as it has been observed across a wide range of different interaction based tasks. However, the variation in the methods currently employed in the mimicry literature also makes it difficult to directly compare studies, for example when trying to establish typical effect sizes. These include different manipulations

of behaviour in terms of unclear duration and frequency of exposure to the target gestures. In addition, the frequent absence of a recognised control measure often leaves the presence of mimicry implied (i.e., relatively greater mimicry when primed versus not primed with affiliation goal) rather than directly observed (i.e., mimicry vs. baseline behaviour). However, there are still concerns regarding the methods employed when control measures are implemented. I return to these methodological issues later on in the chapter. The next section will concentrate on theories and evidence put forward to explain how being exposed to these target gestures results in nonconscious mimicry behaviour.

1.3 Underlying Mechanisms of Nonconscious Mimicry

In most of the research discussed thus far in this review a participant interacts with a confederate who performs a target gesture, such as face-rubbing or foot-shaking and the participant shows an increased tendency to express the same behaviour. This effect of perceived behaviour on observable behaviour has been proposed to occur automatically, via a direct link between perception and behaviour (Chartrand & Bargh, 1999; Dijksterhuis & Bargh, 2001). The following section will discuss the characteristics of an automatic process and the evidence for nonconscious mimicry fulfilling these characteristics. Following this, the mechanism posited to underlie nonconscious mimicry, namely, the perception-behaviour link will be reviewed.

1.3.1 Automaticity

An automatic process in its broadest sense is any process that occurs without conscious control (Manstead & Hewstone, 1995). However, Bargh (1994) proposed four more precise properties of automatic processes. Firstly, automatic processes are activated and run to completion without conscious awareness. In the case of nonconscious mimicry, participants may be aware of a confederate's behaviour or their own behaviour to some degree, but are proposed to have no conscious awareness of the influence of the former on the latter (Chartrand, 2005). Secondly, automatic processes occur without intention. These processes are activated or started in the absence of the goal or the will to do so. Thus, it is the mere perception, or priming, of a behaviour that is proposed to start the process, not the intention to do so by the individual. Thirdly, automatic processes operate without control. This criterion is closely tied to the previous intentionality criterion, which proposes that

automatic processes start without intention. Operating without control refers to the inability to stop or disrupt the process once it has started. Lastly, automatic processes are efficient, needing little or no cognitive resources to occur. It is worth noting, however, that the majority of automatic processes or behaviours are not purely automatic, in the sense that they meet all four of the criteria that define automaticity. Rather, automatic processes tend to exist on a continuum, meeting some of the characteristics of automatic processes, while also showing some level of controlled processing (Bargh, 1992; Moors & De Houwer, 2007).

While Bargh's (1994) classification of automaticity deals largely with processes or behaviours that are triggered unconsciously by perceived stimuli in the environment, Wheatley and Wegner (2001) outlined two different routes by which automaticity can occur. One such route is through learning. The researchers proposed that some behaviours or skilled actions that require conscious effort to begin with can become automatic after a period of practice and repetition. This type automatic behaviour has been demonstrated in reading acquisition (see MacLeod, 1991 for review) and numerical proficiency (Naparstek & Henik, 2010). Wheatley and Wegner's (2001) second route of automatic behaviour is relatively consistent with the manner in which Bargh (1994) outlines automaticity, discussed above.

Although Bargh's (1994) four criteria characterising automatic effects have been very influential in social cognition research (e.g., cited by 849, Google Scholar, 2011), often a generalised approach to identifying and defining these automatic effects has been taken. For instance, testing for and demonstrating a behaviour occurring with efficiency alone has led to that behaviour being termed automatic (Poldrack et al., 2005). In addition, processes or behaviours that occur without monitoring have also been proposed to be automatic. Specifically, 'without monitoring' has been referred to as processes or behaviours occurring without the need for conscious guidance (Wheatley & Wegner, 2001) and occurring without intentional setting of goals and intentional assessment of the outcome (Tzelgov, 1999). The main difference between Bargh's (1994) automatic criteria and automatic processes occurring without monitoring is the generalisation of awareness, intention and control into the simplified 'monitoring' term. The key issue here is the tendency to over simplify how an automatic process or behaviour is defined. This generalisation or blanket term of automaticity provides little information about where a

particular process or behaviour falls on the continuum of exhibiting automatic or controlled properties (Bargh, 1992; Moors & De Houwer, 2007).

This broad use of the term automatic is particularly highlighted in nonconscious mimicry research. The manner in which mimicry was initially characterised as an automatic effect was through retrospective awareness checks. As participants are generally unable to report any awareness of both the confederate's behaviour and their own mimicry behaviour, mimicry was proposed to be an automatic, unconscious effect. This retrospective awareness measure has since become the most frequently used method to establish nonconscious mimicry occurring without awareness (Ashton-James & Chartrand, 2009; Ashton-James et al., 2007; Bailenson & Yee, 2005; Cheng & Chartrand, 2003; Finkel et al., study 5, 2006; Johnston, 2002; Lakin & Chartrand, 2003; Lakin et al., 2008; van Baaren et al., study 3, 2003b; van Baaren et al., study 1, 2004a; Vrijisen et al., 2009; 2010; Yabar, et al., 2006). In addition, this retrospective measure has also been used to imply that mimicry occurs without intention (Chartrand & Bargh, 1999; Lakin & Chartrand, 2003; Vrijisen et al., 2010) and without control (Lakin & Chartrand, 2003). However, there are some studies that claim nonconscious mimicry was occurring automatically without employing any type of awareness check measures (van Baaren et al., 2003a; van Baaren et al., 2003b; van Baaren et al., 2006).

Demonstrating the occurrence of nonconscious mimicry without awareness through retrospective measures is the first step toward establishing mimicry as an automatic effect. However, further clarification of the role of awareness in mimicry behaviour is needed, as is an examination of the remaining three criteria of automaticity in order to elucidate the automatic nature of nonconscious mimicry. A closer examination of the automatic nature of nonconscious mimicry is particularly important because the automaticity of the effect is central to the proposed underlying mechanism driving mimicry behaviour. Specifically, automaticity is predictive of processes and behaviours proposed to occur by means of the perception-behaviour link.

1.3.2 The Perception-Behaviour Link

Similar to previous findings in cognitive research in priming and its effect on subsequent processing and action (Ferguson & Bargh, 2004; Higgins, 1996), the activation of social

information (e.g., traits, attitudes, exemplars and stereotypes) through perception or priming makes that information more accessible and influences subsequent processing and behaviour (Aarts & Dijksterhuis, 2003; Dijksterhuis & van Knippenberg, 1998; Wheeler & Berger, 2007). Importantly, just as objects and social information are proposed to be mentally represented, behaviour and motor actions have also been proposed to be mentally represented in memory (Berkowitz, 1984; Jeannerod, 2001) and it is proposed that perception automatically activates behavioural responses (Bargh, Chen, & Burrows, 1996). Thus, perceiving an individual touching their face activates a mental representation of that behaviour, which increases the tendency to express observable face-touching in the observer (Dijksterhuis & Bargh, 2001; Wheeler & DeMarree, 2009). This direct link has been proposed to be the underlying mechanism of nonconscious mimicry (e.g., Chartrand & Bargh, 1999; Dijksterhuis & Bargh, 2001; Chartrand & van Baaren, 2009; Wheeler & DeMarree, 2009).

Although there is little direct evidence of the perception-behaviour link driving nonconscious mimicry, empirical findings are consistent with the account. Specifically, the mere exposure to certain behaviours or target gestures results in increased instances of expressing the target gesture in the observer, without their awareness (Chartrand & Bargh, 1999; van Baaren et al., 2006). This mimicry could certainly be explained by the perception-behaviour link, but there is no empirical evidence that speaks directly to this issue. Indeed, the majority of empirical evidence of automatic prime-to-behaviour effects has come from other bodies of literature, namely the social priming literature. The following section will review empirical evidence from the social priming literature of perceived social information automatically influencing behavioural outcomes.

1.3.3 Automaticity in Social Perception-to-Behaviour Effects

Evidence for the automatic nature of social behaviour within the social cognition literature primarily emerged through research examining the influence of perceived social information, such as traits and stereotypes, on subsequent behaviour (Bargh, Chen, & Burrows, 1996; Dijksterhuis & van Knippenberg, 1998). Priming the trait 'rude' or the stereotype 'elderly', for instance, results in individuals automatically assimilating their behaviour in line with the activated construct, such as, expressing more instances of interrupting behaviour or adjusting walking speed to a slower pace (Bargh et al., 1996).

Importantly, these social primes were presented either subliminally or by an ostensibly unrelated task, such as a sentence scramble or lexical decision task, to help ensure that participants were either unaware of the prime itself or unaware of the influence of the prime on their behaviour (Bargh & Chartrand, 2000). Furthermore, it seems unlikely that an individual would intentionally express behaviour typically viewed as negative, such as ‘rudeness’ (Bargh et al., 1996) or ‘stupidity’ (Dijksterhuis & van Knippenberg, 1998). Rather, the evidence from the social priming literature suggests that the perceived social information, such as traits and stereotypes, automatically influenced participants’ subsequent behaviour without their awareness or intention, and with relative efficiency (Gilbert & Hixon, 1991; van Knippenberg, Dijksterhuis, & Vermeulen, 1999).

The findings reviewed above do not suggest that perception of all encountered social constructs or behaviour always automatically lead to corresponding behaviour: there is some degree of flexibility. Perception leading to automatic behavioural responses is typically the “default route”, but this can be inhibited and perception of an action can be prevented from leading to actual behaviour. Factors such as current or chronic goals conflicting with behaviour, disincentives or high cost of performing the behaviour and increased self-focus have been shown to inhibit direct perception-behaviour effects (see Dijksterhuis & Bargh, 2001 for review).

This flexibility of the perception-behaviour link is particularly highlighted in more recent models of automatic effects incorporating these social constructs (Dijksterhuis, 2005; Dijksterhuis, Chartrand, & Aarts, 2007; Wheeler & DeMarree, 2009). Specifically, these models propose two distinct routes linking perception and observable behaviour. The direct route posits it is possible for perception to directly activate motor programs. This is most analogous with mimicry effects, such as simply perceiving face-rubbing directly resulting in the increased tendency in the perceiver to express face-rubbing (Chartrand & Bargh, 1999).

The indirect route proposes that the link between perception and behaviour can be mediated by social constructs, such as traits and stereotypes (Dijksterhuis et al., 2007; Wheeler & DeMarree, 2009). A trait or a stereotype, for instance, is not generally a concrete behaviour in and of itself (e.g., the trait ‘polite’ does not correspond with a specific behaviour, but can be manifested into a variety of behaviours). Accordingly,

perceiving and activating the trait polite subsequently activates the related behaviours that are mentally represented with the concepts of that trait (Dijksterhuis & Bargh, 2001), thus mediating the perception-behaviour link. Likewise, the perception of a concrete behaviour (e.g., face-rubbing) can also be susceptible to this type of influence from social constructs, personal or contextual factors (Dijksterhuis et al., 2007; Gilbert & Malone, 1995). This indirect route may clarify how the numerous personal and social factors that have been shown to moderate the tendency to express mimicry behaviour (e.g., Cheng & Chartrand, 2003; Lakin & Chartrand, 2003; van Baaren et al., 2004a) can affect what has been proposed to be a 'direct' link between perception and behaviour.

Prior to Chartrand and Bargh's (1999) demonstration of nonconscious mimicry and their suggestion that the perception-behaviour link underlies the mimicry effect, this mechanism had primarily been applied to automatic trait and stereotype priming effects, as discussed above. Importantly, Chartrand and Bargh (1999) cite the ideomotor theory, prominent in the imitation literature, as evidence that a mechanism exists that could allow the perception of actual behaviour and the expression of behaviour to be directly linked. As put forward by Prinz (1997), perception and action share a common coding system; thus, perception of a behaviour also activates the motor programs to instigate similar observable behaviour. Chartrand and Bargh (1999) posited this ideomotor framework could also be applied to priming social behaviour in a similar manner to the perception-behaviour link mechanism documented in the trait and stereotype priming literature.

1.3.4 Summary

Chartrand and Bargh's (1999) initial demonstration that the mere perception of an individual's behaviour results in increased instances of that behaviour in the observer has led to two key assumptions regarding the nature of nonconscious mimicry. Firstly, this relationship between observed and expressed behaviour has been suggested to occur by means of a direct link between perception and motor behaviour (Bailenson & Yee, 2005; Dalton et al., 2010; Dijksterhuis & Bargh, 2001; Lakin & Chartrand, 2003; Lakin, 2006; van Baaren et al., 2006; van Baaren et al., 2009). Support for the perception-behaviour link as the underlying mechanism responsible for nonconscious mimicry has primarily come from the second assumption within the literature, namely, the automaticity of the effect. Of the four criteria for automatic processes or behaviours —operating without awareness,

without intention, without control and with high efficiency (Bargh, 1994)—mimicry has only been considered in relation to awareness. There is some evidence that mimicry occurs without awareness. However, this has only been demonstrated via the use of self-report measures. The current understanding and theoretical frameworks for perception automatically influencing behaviour has mainly come from research priming social constructs (e.g., Bargh et al., 1996; Dijksterhuis & van Knippenberg, 1998), not priming actual behaviour. The extent to which these two distinct constructs are directly related is unclear, as is whether they share relatively similar mechanisms in terms of automatic effects. The imitation literature, on the other hand, is more developed in terms of theories outlining the mechanisms underlying how perceived behaviour influences motor behaviour.

1.4 Imitation

Although the nonconscious mimicry literature and the imitation literature have largely developed separately from each other, they share similar features. Specifically, nonconscious mimicry and imitation effects both involve an individual's tendency to express behaviour that matches observed behaviour. Furthermore, the imitation literature has been instrumental in developing and accruing evidence in support for the contemporary ideomotor theory, which was initially used to explain how the perception-behaviour link could extend to priming social behaviour in the mimicry literature (Chartrand & Bargh, 1999). Thus, in this section the processes by which imitation is proposed to operate will be considered to see whether it informs the processes by which mimicry may occur.

This overview is not an exhaustive review of the imitation literature (for a review, see Iacoboni, 2009; Meltzoff & Prinz, 2002; Prinz, 2005). Instead, the following sections primarily aim to further examine the mechanisms underlying behaviour matching effects. The characteristic paradigms employed to demonstrate imitation will be briefly reviewed before turning to the behavioural and neurological evidence for proposed mechanisms underlying imitation. Subsequently, the two dominant theoretical models that present a framework for these mechanisms will be discussed. These include the ideomotor theory (Prinz, 1997) and the associative sequence learning model of imitation (Heyes, 2001; Meltzoff & Prinz, 2002). Notably, the imitation literature uses slightly different terminology to describe behaviour matching tendencies, which will be adopted in the

following section in keeping with the literature. Whereas mimicry has been described as the perception of behaviour influencing expressed behaviour in previous sections, imitation effects are described below in terms of observation and execution of action.

1.4.1 Definition

Imitation effects have been broadly defined as the tendency to copy the body movement of another (Brass & Heyes, 2005) and, more specifically, direct matching between observed and executed behaviours or actions (Iacoboni et al., 1999; van Schie, van Waterschoot, & Bekkering, 2008). However, this definition in the imitation literature is largely framed by the mechanism supporting imitation, rather than the observable behaviour matching that occurs. Namely, imitation effects are widely described as the observation of an action activating the motor programmes needed to execute that action in the perceiver, and it is this relationship between observation and execution of action which is measured by imitative behaviour (Blakemore & Frith, 2005; Brass, Bekkering, & Prinz, 2001; Catmur et al., 2008; Liepelt, von Cramon, & Brass, 2008; Prinz, 1997; Rizzolatti & Craighero, 2004).

1.4.2 Characteristic Imitation Paradigms

Early evidence provided by Brass and colleagues (2000) demonstrated how perception of motor action is unique to imitation behaviour, compared to behaviour execution prompted by non-movement cues. The authors employed a choice reaction time task, participants were instructed to imitate a finger movement when shown a video-recorded index and middle finger lifting movement. In a separate block of trials, participants were asked to respond to symbolic cues in front of the target hand which made no movement (e.g., the digit 1 cued an index finger movement, and the digit 2 cued a middle finger movement). The authors found that observing the target hand perform actual finger movements led to faster reaction times to execute the same action, compared to responding to the symbolic digit cues. This evidence suggests that imitation movements may be more readily executed, by means of the similarity between the perceived action and the actual action performed, compared to movements with more abstract cues, such as the digit cue used by Brass and colleagues (2000). Congruent findings that observing finger movements may have a stronger influence on action execution compared to non-movement cues have been

demonstrated when symbolic cues were spatially compatible to the movement cues (e.g., the symbolic cues were placed on the actual finger images) (Brass et al., 2000).

Behavioural evidence for imitation effects have typically followed this type of instructed hand or finger movement task employed by Brass et al. (2000). To further demonstrate how observed action directly affects the execution of action, stimulus-response compatibility paradigms have largely been adopted in the imitation literature (e.g., Brass, Bekkering, Wohlschläger, & Prinz, 2000; Brass et al., 2001; Gillmeister, Catmur, Liepelt, Brass, & Heyes, 2008; Leighton, Bird, Orsini, & Heyes, 2010; Liepelt et al., 2008). In this type of paradigm, interference effects have been demonstrated that arise when executing a different action to the one that is observed.

Heyes, Bird, Johnson and Haggard (2005), for instance, presented a target hand by video in a semi-open starting position. In half of the trials the target hand performed a closing movement and in the other half of the trials an opening movement, which was randomised across the experiment. Participants completed a simple reaction time task in which they were instructed to perform the same pre-specified movement (e.g., opening their hand) as quickly as possible when they saw the target hand perform an action. In some trials participant's movements were compatible with the target hand movement (e.g., opening their hand when the target hand opened) and some trials the participants movements were incompatible with the target hand (e.g., opening their hand when the target hand closed). Importantly, the direction (e.g., opening or closing) of the target hand movement was task irrelevant, indicating when participants had to execute the instructed movement, not what movement to make. Even though the direction of the target hand's movement was irrelevant it still had an effect on participant behaviour. Participants' pre-instructed hand movement was facilitated (e.g., faster reaction times and fewer errors) when observing a congruent movement, but observing an incongruent movement to their own intended action resulted in interference (e.g., slower reaction times and greater errors) of the execution of action.

This type of facilitation and interference effect has been demonstrated in similar stimulus-response compatibility paradigms employing finger movements (Brass, Bekkering, & Prinz, 2001), grasping orientation (Craighero, Bello, Fadiga, & Rizzolatti, 2002), vertical and horizontal arm movements (Kilner, Paulignan, & Blakemore, 2003) and foot

movements (Gillmeister et al., 2008). The facilitation and interference effects demonstrated above are proposed to be the result of the relationships between observed and executed movements. When observed action shares a high degree of similarity to the instructed response movement, the observation of that movement may pre-activate or prime that response movement (Brass et al., 2000; Sturmer et al., 2000). This activation or priming then leads to faster and more accurate responses.

These typical imitation paradigms underscore the finding that individuals more readily execute behaviour that imitates an observed behaviour compared to non-imitative actions, and this type of facilitation appears to be specific to motor movements (Brass et al., 2000). The fact that interference effects arise when executing a different action to the one observed (Heyes et al., 2005) suggests that observation and execution of motor actions are tightly linked. However, there has been scepticism regarding the stimulus-response compatibility paradigm's ability to demonstrate that this link is specific to imitation effects.

1.4.3 Summary

The typical stimulus-response compatibility paradigms employed in the imitation literature discussed above have provided behavioural evidence that suggests the observation and execution of action are closely linked (Catmur & Heyes, 2010). The evidence indicates individuals more readily perform actions that match or imitate an observed action, compared to performing an action that does not match the observed action (Brass et al., 2000; Gillmeister et al., 2008; Heyes et al., 2005; Kilner et al., 2003). Moreover, the perception of motor movement appears to have a unique relationship with the observer's executed action that is not present with non-motor cues (Brass et al., 2000; Sturmer et al., 2000). To understand how observing an action can translate to matching motor behaviour the next section will review the evidence for proposed mechanisms of imitation effects.

1.5 Underlying Mechanisms of Imitation

This section will review the neuroscience evidence supporting the close relationship between perception and behaviour, and the implication of imitation as an automatic effect. Following this, two of the dominant theoretical models, the ideomotor theory and the

associative sequence learning model (ASL), will be reviewed as potential frameworks supporting the neural and behavioural evidence for the mechanism driving imitation effects.

1.5.1 Neural Evidence for the Relationship Between Perception and Behaviour

The recent discovery of a mirror neuron system in humans (e.g., Buccino et al., 2001; Gallese & Goldman, 1998; Iacoboni et al., 1999) provides support for a mechanism linking perception with motor action proposed in behavioural imitation research. In the most basic sense the mirror neuron system provides a functional neural mechanism with matching properties (Heyes, 2010). When an individual perceives an action, there is a simultaneous activation of the motor region involved when the perceiver executes the same action themselves (Gallese, Keysers, & Rizzolatti, 2004).

Iacoboni and colleagues (1999) examined the neural correlates involved in observation and execution of hand movements using functional magnetic resonance imaging (fMRI) which provided support for the mirror neuron system's role in imitation. Using a choice reaction time paradigm to that typically used in the imitation literature (Brass et al., 2000), participants first observed a target hand lifting the index and middle fingers, or a spatial marker appearing on the fingers which made no movement. In a second block of trials, participants were instructed to execute an action based on the target hand they were presented with (e.g., imitate the lifting action of the target fingers or perform a lifting action to correspond with the spatial marker). The authors found that during observation alone, activation was present in two areas of the posterior inferior frontal gyrus (pIFG). However, this activity increased, or produced a larger signal intensity, when the target hand performed a finger lifting action and participants were required to imitate the action. Moreover, in trials where participants were required to observe and execute an action, greater activation in the pIFG was observed in imitative action compared to actions cued by the spatial marker (Iacoboni et al., 1999). Consequently, several other researchers have found evidence which demonstrates similar patterns of activation of the pIFG during imitation behaviour (Koski et al., 2002; Molnar-Szakacs et al., 2004; Muhlau et al., 2005).

While this provides correlation evidence that activation in the pIFG is in some way related to imitation behaviour, Heiser and colleagues (2003) employed a high-frequency repetitive

transcranial magnetic stimulation (rTMS) approach to further explore the causal relationship between pIFG activation and imitation. Specifically, rTMS can be used to temporarily disrupt brain functioning in small, targeted areas (Iacoboni et al., 2005). Thus, if activation of the pIFG was integral to imitation, rTMS applied to the pIFG should disrupt or interfere with observable imitation behaviour. Heiser and colleagues found when rTMS was applied to the pIFG, performance on an imitation task was substantially impaired, in terms of higher error rates and slower reaction times, compared to a control motor task. This implies the pIFG may have a more causal role in facilitating imitation. However, some researchers posit that TMS capabilities do not yet have the accuracy to target such specific areas. Thus, the evidence for this type of precise neural circuitry between observation and execution of a specific action remains inconclusive (Brass & Heyes, 2005).

Although other regions may also be involved in mapping observed action onto matching motor codes (Catmur, Mars, Rushworth & Heyes, 2011), the indication that similar neural regions are cultivated in both perceiving and performing a certain action provides a plausible neural mechanism that may allow perception to automatically influence behaviour without mediating cognitive processes (Iacoboni, 2009; Rizzolatti & Craighero, 2004). Returning to the behavioural research on imitation effects, the suggestion that imitation is an automatic effect is one such implication of this link between observation and execution of action.

1.5.2 Automaticity of Imitation

Researchers examining imitation effects often use the term “automatic imitation” to describe the tendency to respond faster to task irrelevant matching actions compared to non-matching actions (Berthenthal, Longo & Kosbud, 2006; Catmur, Walsh, & Heyes, 2009; Heyes et al., 2005; Jansson, 2007; Kilner et al., 2003; Leighton et al., 2010; Longo & Bethenthal, 2004; Press et al., 2008; van Schie et al., 2008). This automatic label can be seen to stem from the finding that the imitation effect has been shown to meet two of Bargh’s (1994) automaticity criteria, namely, operating with efficiency and without intention.

One of the hallmarks of automaticity is the efficiency of an effect; as such, the effect should need little or no cognitive resources to occur (Bargh, 1994). Evidence provided by the stimulus-response compatibility paradigm indicates that imitative actions are efficient. Specifically, the predominant response of participants is to imitate the target hand, as shown by faster response times to execute the action when the target movement is compatible. When observing a movement incompatible with the instructed action, interference effects occur, as shown by slower reaction times. This difference in reaction time suggests that participants must exert effort to control or inhibit the tendency to perform an imitative movement. This type of interference between automatic and controlled processes is analogous to findings employing the Stroop task (see MacLeod, 1991 for review). Stimulus-response paradigms, which show similar interference effects between the automatic tendency to imitate an action but that is incompatible to the task instructed (controlled) action, can be regarded as a manual or motor version of the Stroop task (Shin, Proctor, & Capaldi, 2010; Brass, Derrfuss, & von Cramon, 2005). This suggests that executing an action that matches an observed action is efficient and that when this tendency is suppressed, some degree of cognitive resources are needed.

However, more direct evidence for the efficiency of imitation effects has been provided by examining the manner in which limited cognitive resources influence imitative behaviour (van Leeuwen, van Baaren, Martin, Dijksterhuis, & Bekkering, 2009). Using a similar paradigm to Brass et al. (2000), participants were asked to respond to either a finger movement or a spatial marker on a target hand image. In addition to responding to the presented hand image, participants simultaneously completed an auditory N-back task. The authors found that when participants imitated the action of the target finger there was no difference in reaction times between those given the highly demanding version or the N-back task (e.g., 2-back) and the less demanding version (e.g., 0-back). However, there was a detriment in action responses to the spatial marker cue when cognitive resources were limited. Thus, it appears observation of a motor action and execution of the same motor action is efficient, whereas the execution of the same action based on a non-motor cue requires some level of cognitive resources. This finding together with interference effects demonstrated by the stimulus-response compatibility paradigm suggests imitation meets the efficiency criterion of automaticity.

Imitation has also been shown to occur without intention by the nature of the stimulus-response compatibility paradigm. When participants are instructed to make a pre-specified movement as quickly as possible, such as opening their hand, the target hand movement simply acts as a go signal. Thus, the direction of the target movements is always task irrelevant. The robust finding that reaction times to execute the pre-instructed movement are different between observing compatible and incompatible target movements (see Prinz, 2005 for review) has been considered unintentional because it conflicts with task instructions (Catmur & Heyes, 2009; Leighton et al., 2010). This difference suggests that the relationship between observation and execution of an action influences the behaviour of participants without their intention. Therefore imitation appears to meet the unintentional criterion of automaticity.

This relationship between observation and response of the same action that defines imitation has largely been considered an automatic effect, occurring with high efficiency and without intention (e.g., Catmur & Heyes, 2009; Leighton et al., 2010; van Leeuwen et al., 2009; van Schie et al., 2008). Two dominant theoretical models in the imitation literature, the ideomotor theory and the associative sequence learning (ASL) model have endeavoured to provide a framework to explain the behavioural and neural evidence of this automatic link between observation and execution of the same action.

1.5.3 Theoretical Mechanisms of Imitation

One of the earliest explanations of the relationship between perception and behaviour is the ideomotor theory. This posits the mere ideation or perception of an action initiates performance of that action, making the execution of that action more likely (James, 1890; Greenwald, 1970). Extending this ideomotor principle, Prinz (1997) proposed a common-coding mechanism, later expanded to the theory of event coding (TEC) (Hommel, Musseler, Aschersleben & Prinz, 2001), to support findings on this relationship between perception and action. Specifically, Prinz (1997) and Hommel et al. (2001) suggested that rather than perceptual processes and action planning processes occurring separately from each other, perceived actions and to-be-produced motor actions share a common mental representation, or a common coding system. The ideomotor account implies the visual representation of a perceived behaviour and the motor representation that drives observable action are organised such that they are tightly linked, overlapping representations (Brass &

Heyes, 2005; Iacoboni, 2009; Leighton, Bird, & Heyes, 2010). By means of this common or overlapping coding system, the mere perception of an action activates the motor representation or motor programs to perform the observed action and no other transitional processes are needed (Aicken et al., 2007; Iacoboni, 2009; Prinz, 2002).

The second dominant model providing a framework to explain imitation effects is the associative sequence learning (ASL) model (Heyes, 2001). The ASL model shares relatively similar views to the ideomotor theory that perceptual input of action is directly linked to, and can activate, the motor program to execute that same action. The ASL model suggests perceptual and motor representations are two separate processing systems, but become connected or linked through experience and associative learning (Catmur et al., 2009; Iacoboni, 2009). Similar to Wheatley and Wegner (2001) discussed previously, learned behaviours can become automatic over time. By observing and executing a given action a learned association between the perceptual and motor representations for that action is formed (Catmur et al., 2009; Iacoboni, 2009).

Heyes et al. (2005) provided support for the ASL account by replicating facilitation and interference effects typical in stimulus-response compatibility paradigms. However, in a follow up study the authors used a training task with the participants whereby half of the participants received compatible or imitative training with a target hand presented by video (e.g., to perform a hand closing movement when shown the target hand make a closing movement). The other half of the participants were trained to make incompatible movements (e.g., to perform a hand closing movement when shown the target hand make an opening movement). After this relatively brief training period, the authors found that the typical facilitation and interference effects were eliminated for those who were experienced in executing incompatible movements. Similar results of training have even been demonstrated across different effectors, with Gillmeister and colleagues (2008) replicating this finding that brief training reduced typical interference effects using hand and foot movements. Together, these studies suggest that the relationship between the observation and execution of actions can be altered by experience and that learned associations appear to be relatively flexible in forming new associations, in this case through brief periods of training.

Recent evidence for the mirror neuron system and its role in imitation complement the ideomotor framework and the ASL model. The finding that overlapping cortical areas that are activated both when perceiving and executing the same action (Iacoboni et al., 1999, Rizzolatti, Fogassi, & Gallese, 2001) appears to directly meet the assumption of a common coding system in the ideomotor account (Hommel et al., 2001; Iacoboni, 2009). Similarly, in support for the ASL model, whereby links between sensory and motor information are developed through experience associating observation and execution of actions (Catmur et al., 2009; Heyes, 2010), evidence has shown that expert pianists, who have a wealth of experience in the finger movements needed to play the piano, show greater mirror activation when watching piano playing compared to non-pianists (Haslinger et al., 2005).

1.5.4 Summary

Recent neuroscience evidence suggests that there is an association in neural activation when both observing and executing an action (Muhlau et al., 2005; Iacoboni et al., 1999), and provides a plausible mechanism which complements the ideomotor theory and ASL frameworks for imitation behaviour. In addition, both models suggest that observing action automatically (i.e., without intention and with high efficiency) activates the motor programs to perform the observed action in the perceiver. Whereas research in imitation effects has received a considerable amount of attention, and thus has developed a robust understanding of the mechanism and models proposed to underlie behaviour matching, the nonconscious mimicry literature has contributed a better understanding of the application of behaviour matching in everyday life. The following section will consider these convergent bodies of literature jointly with the aim of applying this understanding from the imitation literature to the examination of nonconscious mimicry.

1.6 Synthesis of the Nonconscious Mimicry Literature and Imitation Literature

The nonconscious mimicry literature and imitation literature have taken very different approaches to investigate an individual's tendency to copy or match perceived behaviour. However, recent research is starting to bridge the gap between these two separate bodies of literature, using evidence accrued by one to help inform new avenues of research in the other. This line of research suggests nonconscious mimicry and imitation are different facets of a very similar phenomenon.

Leighton and colleagues (2010) examined the influence of a social factor, prosocial attitudes, on imitation effects. Employing a sentence unscrambling task which has been previously used in the nonconscious mimicry literature (van Baaren et al., 2003b), the authors found those primed with a “prosocial” affiliative attitude (e.g., *affiliate*, *friend* and *associate*) showed greater facilitation effects (e.g., faster reaction times) compared to those primed with a neutral or anti-social attitude. These findings suggest that these primed attitudes appear to influence imitation effects, in a similar manner to the way in which affiliative attitudes (e.g., liking and rapport) affect mimicry behaviour (Cheng & Chartrand, 2003; Lakin & Chartrand, 2003). Taking an approach more analogous to the paradigms used in the nonconscious mimicry literature, Stel and colleagues (2009) explicitly instructed participants to imitate or not imitate the face-rubbing and pen-playing behaviour of a confederate presented by video. The authors found those instructed to engage in imitation subsequently reported liking the confederate more than those instructed not to imitate, suggesting that liking can be elicited by instructed imitation, as found in nonconscious mimicry (Bailenson & Yee, 2005; Lakin & Chartrand, 2003; Lakin et al., 2003).

Conversely, research on nonconscious mimicry has begun to expand its focus to address research questions more typically addressed in the imitation literature. The neural correlates that are activated when observing a pair interacting in which mimicry does or does not occur has begun to be investigated (Kuhn, Muller, van Baaren, Wietzker, Dijksterhuis, & Brass, 2010). Specifically, the authors found preliminary evidence of neural activation in the medial orbitofrontal cortex and ventromedial prefrontal cortex, areas associated with emotion and reward processing, when observing mimicry behaviour which the authors propose may be linked to the positive consequences arising when mimicry occurs.

The emerging evidence suggests that these two behaviour matching effects, nonconscious mimicry and imitation, maybe more closely related than previously considered. Indeed, nonconscious mimicry effects have been described in the imitation literature as a different form of automatic imitation, which demonstrates the social functionality of imitation (Heyes, 2009) in a more naturalistic social environment (Iacoboni, 2009; Catmur & Heyes, 2010). With this in mind, the following section will compare the way in which the focus of

empirical work has varied in examining nonconscious mimicry and imitation effects. This will be done with the view of how the methodological approaches and evidence for the proposed underlying mechanisms in imitation research may further inform future research in nonconscious mimicry.

1.6.1 Methodological Approach

With a view to investigating the ubiquitous nature that nonconscious mimicry occurs, the mimicry literature has employed a number of different paradigms and different measures of mimicry behaviour. Although this has resulted in a better understanding of the social functionality of nonconscious mimicry, some of the more basic features of the effect are less well understood. Conversely, in the imitation literature, the paradigms employed have been relatively consistent in assessing imitation, using choice and simple stimulus-response compatibility paradigms and regularly taking measures of reaction times to execute target behaviour. This consistency across the imitation literature has enabled behavioural and neurological research to merge relatively seamlessly, allowing for a better understanding of the unique relationship between perception and behaviour.

As discussed earlier in the chapter, there are potential methodological issues within the mimicry literature, due to this range of different paradigms and methods employed, which must be addressed. These include the consistency of gesture primes, the variability in designs, what is measured as mimicry and the reliability of the effect. Some of these issues may be ameliorated by drawing from the methodological approaches taken in the imitation literature. The methodological components to demonstrate both mimicry and imitation behaviour can be broken down into two primary elements: specifically, how the target behaviour is presented to participants and how the actual imitation or mimicry behaviour expressed is measured.

1.6.1.1 The Use of Live and Video-Recorded Gesture Presentation

Imitation effects have typically been demonstrated by employing video-recorded or picture sequences of target actions, such as hand and finger movements (e.g., Berthenthal, Longo & Kosobud, 2006; Brass et al., 2001; Craighero et al., 2002; Leighton et al., 2010). This has allowed for a high degree of control over how these target actions are presented to

participants. Specifically, pre-captured movement images has allowed researchers to consistently present the onset of target action, duration of action observed and uniformity of action presentation over multiple trials. The use of a live confederate carrying out target actions is relatively rare in the imitation literature, with the exception of Kilner and colleagues' (2003) comparison of imitation effects when observing human versus robotic movements, and imitation studies using children as the tested population (Bekkering, Wohlschlagel, & Gattis, 2000).

Conversely, the majority of the paradigms demonstrating nonconscious mimicry effects have involved a live confederate completing an interaction based task in person with participants. Using a live confederate in nonconscious mimicry research has been valuable, considering the majority of research examining mimicry has focused on how this effect facilitates and influences social interactions (e.g., Ashton-James et al., 2007; Chartrand & Bargh, study 2; 1999; Cheng & Chartrand, 2003). Furthermore, the use of a live confederate simulates a more natural face-to-face interaction and would more accurately portray a social situation to gauge this influence of mimicry behaviour. However, nonconscious mimicry paradigms can benefit from adopting a video based paradigm, as used to investigate imitation.

As discussed earlier in this chapter, there are a number of uniformity issues across the mimicry literature, such as poor specification of the duration and overall frequency of exposure to target gestures. This lack of clarity in the priming mechanism that is eliciting mimicry behaviour limits comparisons across the literature and hinders a better understanding of the nature of the mimicry effect itself. Employing a method using a pre-recorded video of an actor or confederate would ensure all participants are exposed to exactly the same frequency, duration and quality of target gestures during a task in which mimicry behaviour is measured. Importantly, there is evidence from the mimicry literature that suggests that comparable findings of nonconscious mimicry can be observed employing both a live confederate and video based paradigm (e.g., Ashton-James et al., 2007; Cheng & Chartrand, 2003; Lakin & Chartrand, study 1, 2003; van Baaren et al., study 1, 2004a; Yabar et al., 2006). This suggests that a live interaction is not an antecedent for mimicry to occur, and a video based paradigm could be used to address the issues discussed above without hindering the demonstration of nonconscious mimicry.

In addition to improving consistency issues, the use of video based gesture presentation allows for further investigation of more fine-grained aspects of the target gestures being presented and how these factors influence mimicry behaviour. The imitation literature has taken advantage of the subtle manipulation of video-recorded action to provided further insight on how the amount of exposure to action influences imitation, the time course of the effect (Catmur & Heyes, 2010) and the effect of observing degraded action images on imitation (Watanabe, 2008). This, in turn, has provided valuable information for the way in which the perceptual qualities of action can influence imitative behaviour. However, this influence of perceptual factors of target gestures, such as amount of exposure and time course, is still not well understood in the mimicry literature and warrants further investigation.

1.6.1.2 Type of Gestures Manipulated

In the imitation literature, the use of hand movements as target gestures has been used extensively. However, this has included several different manipulations of hand movement, such as finger lifting, finger tapping, open and closing movements and grasping objects (e.g., Brass et al., 2001; Craighero et al., 2002). There have been fewer investigations which have used non-hand gesturing, but foot lifting (Gillmeister et al., 2008), arm movement (Kilner et al., 2003) and mouth opening and closing movements (Leighton & Heyes, 2010) have been employed in imitation paradigms. There are fairly robust findings demonstrating the sensitivity of imitation, such as differentiation between index and middle finger movement (see Prinz, 2005 for review), as well as discrete directional movements such as lifting and tapping motions of the same finger (Brass et al., 2001). Although many of these changes to perceived action are subtle, facilitation effects across these fine motor changes suggests imitation effects can generalise to a number of different types of motor actions.

Nonconscious mimicry has primarily been demonstrated via face-rubbing and foot-shaking behaviour (e.g., Chartrand & Bargh, 1999; Lakin et al., 2008; van Baaren et al., 2004a; Vrijksen et al., 2010). The subtle nature of these two gestures is likely to be the reason they are so prolific in the mimicry literature. Namely, face-rubbing and foot-shaking can be classified as adaptor gestures. These gestures do not convey a specific non-verbal meaning, such as a 'thumbs up' gesture to signal approval, nor do they enhance a verbal message

when co-occurring with speech, such as making a circular motion with ones' hands while describing a round object (Ekman & Friesen, 1969). Thus, there would be little reason or goal to intentionally express these gestures, and individuals are rarely aware of expressing or perceiving adaptor gestures (Ekman & Friesen, 1969). Consequently, these characteristics of adaptor gestures makes them ideal for research examining an unconscious, automatic, effect such as mimicry.

Given that mimicry has been demonstrated across a variety of contextual situations and paradigms, it should be expected to generalise across a wide range of behaviours. Yet nonconscious mimicry behaviour has consistently been shown using only a small number of gestures. Although this is not problematic in and of itself, demonstrating that mimicry behaviour extends to additional target gestures would further strengthen the proposed robustness, within the literature, of this effect. In other words, it would suggest there is nothing exceptional about these commonly used target gestures, and that mimicry is a pervasive aspect of behaviour. Considering the ideal qualities of gestures classified as adaptors and the large number of different adaptor gestures that might be used, one potential manner to explore the generalisability of nonconscious mimicry would be to use alternative adaptor gestures within a mimicry paradigm.

1.6.1.3 Measures of Imitative and Mimicry Behaviour

The second primary element of the methodological approach in behaviour matching paradigms is the way in which the imitation or mimicry behaviour expressed by participants is measured, or defined as behaviour matching. Although the two bodies of literature differ widely in terms of how and what type of behaviour is being measured, both posit that the perception of a specific action increases the tendency to express or perform that action (Chartrand & Bargh, 1999; Blakemore & Frith, 2005; Catmur et al., 2008). In imitation effects this refers to the observation of an action leading to the ability to express or execute that particular behaviour more quickly, compared to non-imitative behaviour (e.g., Brass et al., 2000). In mimicry effects, this refers to the observation of target behaviour leading to an increase in the amount (e.g., frequency or duration) that behaviour is expressed in the observer (Lakin et al., 2008; van Baaren et al., 2006; Yabar et al., 2006). However, both bodies of behaviour matching literature approach the questions of

what is considered imitation or mimicry effects, in terms of behavioural comparisons, by employing very different methodological designs.

The imitation literature has consistently employed at least two, and in some cases three, different gesture conditions to examine the way in which perception of different actions effects observable behaviour. In the typical stimulus-response compatibility paradigm blocks of trials consisting of a baseline measure, executing a compatible action and executing an incompatible action are used to measure changes in behaviour (Catmur et al., 2009; Brass et al., 2000). Although some studies simply contrast the reaction times between compatible and incompatible trials (e.g., Brass, Bekkering, & Prinz, 2001; Leighton, Bird, Orsini, & Heyes, 2010), even without the baseline measurement there are at least two different target gesture conditions in which a participant's behaviour can be directly compared to show the influence of perceived action on executed action.

Of the two methodological approaches within the mimicry literature, namely measuring the consequences that arise from being mimicked and measuring the extent to which participants express mimicry behaviour, the latter mirrors the approach taken in the imitation literature more closely. However, unlike the imitation literature, research on the mimicry effect does not typically employ different behavioural conditions to compare changes in participant behaviour (Cheng & Chartrand, 2003; Johnston, 2002; Lakin & Chartrand, 2003; Lakin et al., 2008; van Baaren et al., 2003b, van Baaren et al., 2004a; Vrijnsen et al., 2010; Yabar et al., 2006). Specifically, all participants are exposed to the same target gestures, and any level of expression of these target gestures has been termed mimicry. As all participants are exposed to the same target gesture(s), there is no way to directly compare how behaviour changes based on the perception of a target gesture.

Lakin and Chartrand (2003), for example, found priming the goal to affiliate resulted in participants spending a greater percentage of time mimicking the foot-shaking behaviour of a confederate (e.g., 60%), compared to those not primed with the goal to affiliate (e.g., 40%). However, those given no goal to affiliate still expressed foot-shaking behaviour to some extent. These findings do suggest that mimicry behaviour increases when participants are primed with a goal to affiliate. However, without a measure with which to compare changes in participants behaviour due to the presence of the target gesture it is unclear if behaviour reported as 'mimicry' in the no goal to affiliate group was in fact mimicry

behaviour or simply the natural level that individuals generally express foot-shaking behaviour.

Like the imitation literature, mimicry studies have sporadically employed a pre-experiment baseline measure as a type of control to account for individual differences in behaviour. However, unlike the baseline measure taken in imitation studies, the one minute measure of participant behaviour in the mimicry literature is not experimentally similar to the period in which actual mimicry behaviour is measured. Differences such as the duration of measure, type of experiment task and social context potentially render the baseline measure used in the mimicry literature as an unsuitable stand-alone control measure.

As pointed out earlier in the chapter, there are only four experiments to date within the mimicry literature that have presented different target gestures within experimentally comparable conditions, allowing for a comparison of behavioural changes due to exposure to target gestures (Chartrand & Bargh, 1999; van Baaren et al., 2006; van Baaren et al., 2003b; van Swol, 2003). Yet, there are still issues with the methodological approach in terms of a well-characterised behavioural control group within these four experiments. These are outlined below within each of the experiments individually.

In a different approach to the typical dyad interaction used in the mimicry literature, van Swol (2003) asked participants to interact with two different confederates in a group task. One confederate agreed with the participant's opinion during an interview style task and one did not. In addition, one confederate continually performed foot-shaking, whilst the second confederate continually performed face-rubbing, with the type of gesture and confederates' opinion pairing counterbalanced. The author predicted that participants would mimic the behaviour of the confederate who agreed with their opinion to a greater extent than the non-agreeing confederate's behaviour. Due to the nature of this prediction, the non-agreeing confederate functioned as a control within the interaction. However, mimicry of the agreeing confederate was not observed for either the face-rubbing or foot-shaking gesture, compared to participants' expression of the gesture displayed by the non-agreeing confederate. Although the group interaction is an innovative method to examine whether individuals may preferentially mimic one person over another, the finding that both gestures (when performed by the agreeing confederate) were not reliably mimicked

suggests that mimicry did not occur relative to the behaviour of the author's control, non-agreeing, confederate.

Van Baaren et al. (2003b) used a within-participant design, where participants interacted with a confederate who performed face-rubbing in one session and another confederate who performed foot-shaking in a second session, to examine the effects of self-construal on mimicry behaviour. However, rather than directly comparing changes in participants' face-rubbing and foot-shaking behaviour as a function of what gesture the confederate performed, the authors created two different mimicry index scores. Behaviour that was termed mimicry consisted of the frequency per minute face-rubbing was expressed by participants when interacting with the face-rubbing confederate and foot-shaking expressed when interacting with the foot-shaking confederate. A non-mimicry score was calculated by combining a participant's expression of face-rubbing when interacting with the foot-shaking confederate, and expression of foot-shaking when interacting with the face-rubbing confederate. The combination of behaviour termed mimicry across the two different sessions is potentially problematic, as they are dissimilar behaviour measures taken while interacting with different confederates. Furthermore, by combining face-rubbing and foot-shaking into an index score, this design masks the possibility that one or both gestures expressed by participants did not significantly change across sessions as a direct function of the change of confederate behaviour. For instance, what the authors termed mimicry could have been driven by the face-rubbing gesture alone. Although this design examines the possible generality of the effect and mimicry could still be said to have occurred, the author's design does not allow for a clear examination of this possibility.

Using a similar design and the same target gestures, Chartrand and Bargh (study 1, 1999) more directly demonstrated that participants changed their behaviour as the partner they were interacting with changed their behaviour. Specifically, the authors compared changes in participants' face-rubbing and foot-shaking behaviour separately. They found that participants rubbed their face more with the face-rubbing confederate than with the foot-shaking confederate and, conversely, shook their foot marginally more with the foot-shaking confederate than with the face-rubbing confederate across two sessions within the experiment. These results suggest there was a significant change in expressed behaviour from one gesture to another, relative to the changes in the confederate's behaviour.

This method of manipulating and comparing two target gestures or actions is used throughout the imitation literature (e.g., opening hand and closing hand). However, there are two important differences to consider between mimicry and imitation effects; the (un)conscious nature of the participant's behaviour and the aspect of the behaviour that is being measured. In imitation research, participants are explicitly instructed to make a specific action. Due to the conscious and controlled nature of executing that action, reaction time measures can be used to gauge the influence the two different perceived actions has on participant behaviour.

In mimicry research, participants should be unaware of their own mimicry behaviour of the target gesture. For this reason, the amount of mimicry behaviour participants express (e.g., the frequency or duration) is a more appropriate measure of the extent to which the target gesture influences their behaviour instead of the time it takes to express that behaviour. However, directly comparing the amount of behaviour expressed between two target behaviours to demonstrate mimicry poses a problem. It is unclear if the two gestures Chartrand and Bargh (1999) manipulate normally co-occur in an interaction. For example, it is possible that engaging in foot-shaking behaviour suppresses face-rubbing or other gestures in general. If this is the case, it would imply that the behavioural comparison used by Chartrand and Bargh (1999) may not accurately gauge changes in the amount of behaviour expressed by participants due to mimicry. A cleaner behaviour comparison would be to show the amount of target behaviour expressed by participants' increases when observing a target gesture, compared to the amount that behaviour is naturally expressed.

Van Baaren and colleagues (study 2, 2006) employed such a paradigm to evaluate nonconscious mimicry behaviour relative to natural behaviour patterns within an experimentally comparable condition. The authors provided evidence that participants mimicked the pen-playing behaviour of a video-recorded actor to a greater extent when exposed to the behaviour, compared to watching an actor adopting a neutral body position and performing no pen-playing behaviour. Interestingly, only participants primed with positive affect reliably expressed mimicry above control levels, whereas those primed with negative affect showed no evidence of increased pen-playing when exposed to the target behaviour. This is the only study to date in mimicry research that has used an

experimentally comparable control group that distinctly separates the expression of target gestures due to mimicry from the natural or baseline level the gesture is expressed by an individual. Importantly, the authors provided more substantial evidence that under some conditions, such as inducing negative affect, nonconscious mimicry may not even occur relative to a control condition. This finding has wider implications for the mimicry literature examining the moderators that increase or decrease mimicry behaviour. In particular, it indicates that the reported behavioural changes due to these moderating factors may not have always reliably been mimicry behaviour. Specifically, there is little evidence that the target behaviour expressed by participants was greater than the behaviour they would express in the absence of a target gesture prime.

1.6.1.4 Summary

The methodological issues in the mimicry literature, namely a lack of clarity in the manipulation and measurement of the target behaviour, make it difficult to determine the reliability of the effect and to draw comparisons of mimicry demonstrated across the literature. The widespread use of live confederates within the mimicry literature seems to have further compounded these issues of target gesture presentation. Considering that mimicry has been previously demonstrated by employing video presentation of target gestures (Lakin & Chartrand, study 1, 2003; van Baaren et al., study 1, 2004a; 2006; Yabar et al., 2006), this approach offers greater control and consistency of gesture presentation, a benefit highlighted in the imitation literature.

In addition, the video presentation approach in the imitation literature has allowed researchers to further examine the way in which more subtle characteristics of target action influence imitative behaviour (Catmur & Heyes, 2010; Watanabe, 2008). Yet, it is unclear whether these characteristics of target gestures likewise influence the degree to which an individual expresses nonconscious mimicry. The range of moderators shown to influence mimicry behaviour suggests that mimicry is not expressed equally across different contexts, which may also include the nature of the gestures being mimicked. Thus, research exploring the mimicry effect needs to implement the use of video-recorded gesture presentation in order to examine this possibility and to correct issues regarding the consistency of gesture presentation between participants and experiments.

However it is not only the way that the target gestures are presented that is of concern. There are also potential issues over the way in which mimicry behaviour is measured. One approach may be to take certain design qualities used in the imitation literature and apply these to nonconscious mimicry paradigms. The imitation literature typically presents two different actions that allow for a direct comparison for behavioural changes occurring depending on what behaviour participants are observing. However, in nonconscious mimicry research the use of behavioural comparison conditions are less widely used. Due to the way in which mimicry is measured and the unconscious nature of the effect, implementing two behavioural conditions, one that presents target gestures and one characterised control (no gesture) condition, appears to be the best approach. To date, only one empirical study has adopted this type of design within the mimicry literature (van Baaren et al., 2006). Accordingly, the empirical chapters within this thesis will employ this methodological approach. This should allow participants' behaviour to be more cleanly separated between mimicry behaviour and the natural expression of the target gestures. The aim of which is to provide a straightforward and transparent paradigm with which to explore the automatic nature of nonconscious mimicry. Importantly, addressing these methodological issues is integral for further examination of the nature and mechanisms supporting mimicry behaviour.

1.6.2 The Underlying Mechanisms of Behaviour Matching

In the imitation literature, the theoretical frameworks that posit the close relationship between observation and execution of an action use imitative behaviour as a measure of this relationship (Catmur & Heyes, 2010). As a result, the frameworks put forward to explain the manner in which imitation effects occur have received considerable attention in both behavioural and neuroscience based research (e.g., Gillmeister et al., 2008; Haslinger et al., 2005; Heiser et al., 2003; Heyes et al., 2005; Kilner et al., 2003; van Leeuwen et al., 2009). However, empirical evidence for the mechanisms underlying nonconscious mimicry behaviour has not been as extensively examined. For theoretical frameworks, researchers have borrowed some of the qualities of the proposed mechanisms for imitation behaviour, such as the ideomotor theory (Bargh, 2005; Chartrand & Bargh, 1999) and, to a greater extent, evidence from the wider social priming literature (Dijksterhuis et al., 2007; Wheeler & DeMarree, 2009) to explain the mechanism driving nonconscious mimicry behaviour. The following section will compare how the imitation literature and mimicry

literature have examined the automaticity of these two behaviour matching effects, and how the approach taken in the imitation literature may better inform the proposed underlying mechanisms in nonconscious mimicry.

1.6.2.1 The Automaticity of Behaviour Matching

Of the four criteria of automaticity —operating without awareness, without intention, without control, and with high efficiency (Bargh, 1994)— imitation and mimicry effects do not appear to overlap in automaticity characteristics. Imitation effects are suggested to occur without intention and with high efficiency, whereas mimicry has been indirectly demonstrated to occur without awareness. While this does not suggest that imitation is somehow more or less automatic than mimicry (Bargh, 1992; Moors & De Houwer, 2007), the evidence put forward for the automaticity of imitation has been more compelling.

The behavioural comparison afforded by the methodological approach in imitation paradigms has built the strongest case for the effect's automaticity on the efficiency and unintentional criteria. Indirectly, the finding that imitative responses are executed faster than non-imitative responses is considered efficient as responses are typically faster in automatic processes compared to controlled processes (Tzelgov, 1999). More direct evidence suggests that imitative responses do not degrade under limited cognitive resources whereas non-imitative actions do (van Leeuwen et al., 2009). Evidence for imitation effects occurring without intention has also been demonstrated by the design characteristics of the stimulus-response compatibility paradigm. Participants are instructed to make all pre-specified movement as quickly as possible, yet unintentionally show faster reaction times when that action is imitative versus non-imitative (Catmur & Heyes, 2009; Leighton et al., 2010).

The finding that mimicry occurs without awareness has typically been assessed in a less direct manner, through the use of retrospective self-report of awareness (Chartrand & Bargh, 2000). From this evidence, nonconscious mimicry has been broadly labelled as automatic and the effect has been inferred to operate under the other three main characteristics of automaticity. More direct, particularly objective behavioural evidence is needed to demonstrate mimicry's automaticity beyond participants' report of awareness after mimicry has been expressed. The feature-based approach, in which the main features

of the automaticity of a process are examined separately (Moors & De Houwer, 2007), would provide more clarity and precision in classifying the degree to which mimicry exhibits automatic properties. Since most processes or behaviours are not purely automatic (Bargh, 1992; Moors & De Houwer, 2007), it is possible that mimicry may operate without awareness and without intention (automatic characteristics), but may need some attentional resources (controlled characteristic) to occur.

Moors and De Houwer's (2007) feature-based approach has been implemented recently in the imitation literature through research that directly examines the efficiency of imitation as an automatic effect (van Leeuwen et al., 2009). However, the claim that nonconscious mimicry is automatic has yet to be empirically tested using these more specific criteria. Thus, once the mimicry effect can be reliably demonstrated relative to an experimentally similar control condition, the individual criteria of mimicry's automaticity will begin to be investigated within this thesis. Further examining mimicry's automaticity would also provide greater insight to the proposed underlying mechanism of this effect.

1.6.2.2 The Relationship Between Perception and Behaviour

Both behaviour matching literatures posit that imitation and mimicry effects are the result of a close relationship between perception and behaviour. Within the imitation literature, the frameworks put forward to explain this relationship, namely the ideomotor theory and the ASL model, have driven the construction of designs used to examine imitation effects. Regarding the ideomotor theory, behavioural paradigms to directly test the theory of a common coding system (e.g., Brass et al., 2000; Heyes et al., 2005; Kilner et al., 2003). Likewise, the assumption in the ASL model that the link between perception and behaviour is due to associations forged through learning and experience (Heyes, 2001) has led to several elegant designs that directly test this theory (Gillmeister et al., 2008; Heyes et al., 2005).

In mimicry research, the perception-behaviour link has been considered an extension to the ideomotor theory (Chartrand & Bargh, 1999). For instance, Bargh (2005) used the terms ideomotor theory and perception-behaviour link interchangeably in a review when discussing automatic behaviour matching effects. Although this mechanism has been heavily cited throughout the mimicry literature (e.g., Bailenson & Yee, 2005; Dalton et al.,

2010; Lakin & Chartrand, 2003; Lakin, 2006; van Baaren et al., 2006; van Baaren et al., 2009), there is little direct evidence that the perception-behaviour link underlies nonconscious mimicry behaviour.

The lack of direct evidence for the perception-behaviour link mechanism put forward in the mimicry literature also raises the question of the way in which the numerous social factors demonstrated to moderate nonconscious mimicry behaviour influence this proposed direct link. As discussed earlier, direct and indirect routes to perception-to-behaviour effects have been put forward to explain how subtle social information such as stereotypes, traits and goals can automatically influence or mediate subsequent behaviour effects (e.g., Dijksteruis, 2005).

This framework of extending the perception-behaviour link to include indirect routes, has found support in the social priming literature (for review see, Dijksterhuis et al., 2007; Wheeler & DeMarree, 2009). However, it remains unclear whether priming social information and priming behaviour are directly related. Evidence from the imitation literature suggests that perception of motor action has a unique effect on observable behaviour compared to the perception of more abstract cues (Brass et al., 2000; Sturmer et al., 2000). Yet, the mimicry literature has been built on findings that shows social information and goals, which are relatively abstract cues, have an influence on mimicry behaviour (e.g., Gueguen & Martin, 2009; Lakin et al., 2008; Yabar et al., 2006). By gaining a better understanding of the more basic mechanisms of nonconscious mimicry, the complex nature of the way that social information affects mimicry behaviour can then begin to be explored. As automaticity is one predictor of processes and behaviours proposed to occur by means of the perception-behaviour link, the empirical work in the current thesis will examine the automaticity of nonconscious mimicry as a starting point.

1.6.2.3 Summary

The theoretical mechanism put forward in the nonconscious mimicry literature, the perception-behaviour link, does share many qualities with the two dominant models in the imitation literature, the ideomotor theory and the ASL model. All three models suggest that perception and expression of the same action are closely related, and the mere perception of behaviour can automatically influence the behaviour of the perceiver (Catmur & Heyes,

2010; Chartrand & Bargh, 1999). Importantly, the imitation literature has more rigorously tested whether imitation effects meet or refute the stipulations put forward within these two frameworks. The most direct evidence that a link between perception and behaviour is the mechanism driving nonconscious mimicry is the automatic nature of the effect.

Regarding mimicry, evidence for the automaticity of this effect has been demonstrated to occur without the perceiver's awareness through self-report measures. In imitation research, more concrete evidence that imitation occurs without intention and with high efficiency has been provided, primarily through the methodological approach of behavioural comparisons employed and by direct testing for individual criteria of imitation's automaticity (van Leeuwen et al., 2009). Accordingly, more rigorously testing for the individual criteria of mimicry's automaticity would help build a better understanding of the perception-behaviour link proposed to underlie the effect.

1.7 Final Summary and Outline of Chapters

Over the past ten years, research on mimicry effects has provided a relatively extensive body of evidence demonstrating the pervasive nature with which mimicry behaviour influences social interactions. This includes the unconscious nature with which individuals both mimic the behaviour of others and the inter- and intra-personal effects mimicry can have when an individual is mimicked. In so doing, the mimicry literature has used a variety of methodological approaches to demonstrate mimicry behaviour. With this evidence at hand, it is a good point to step back from the strictly social aspects of mimicry and more closely examine the methods used to demonstrate this effect and the nature of the mechanisms underlying mimicry behaviour. To this end, the imitation literature provides valuable insights to pursue this avenue of research on the mimicry effect. The previously employed methodological approaches that have demonstrated mimicry behaviour, which were discussed above, highlight several outstanding issues that require further attention. These include appropriate controls and the presentation of gesture manipulation, particularly when it is the participants' mimicry behaviour that is being measured.

Firstly, there are some reservations about using a one minute baseline measure in place of a control condition. Although this type of measure is certainly valuable to account for individual differences in behaviour, alone it is not a well characterised control condition.

Secondly, there are concerns regarding how behavioural changes are compared to demonstrate mimicry when different behaviour conditions have been implemented (Chartrand & Bargh, 1999; van Baaren et al., 2003b). It is appropriate to follow van Baaren et al.'s (2006) example, in employing an experimentally comparable control condition, where participants are not exposed to any target gestures to more clearly demonstrate nonconscious mimicry.

Additionally, considering the numerous studies that have demonstrated the diverse social and cognitive factors that moderate nonconscious mimicry, it remains unclear whether there are perceptual factors of the gestures themselves that influence nonconscious mimicry behaviour. These include the generalisability of the effect to alternative target gestures as well as whether the amount of exposure to gestures influence mimicry and the decay rate following exposure. Notably, these perceptual characteristics have been found to influence social prime-to-behaviour effects (Dijksterhuis & van Knippenberg, 1998) as well as imitation behaviour (Catmur & Heyes, 2010; Gillmeister et al., 2008; Watanabe, 2008), but have yet to be explored in the mimicry effect. Moreover, the limited number of target gestures previously employed to show mimicry's occurrence makes it difficult to draw conclusions on the generalisability under which the perception-behaviour link functions with regard to mimicry.

Concerning the nature of the mimicry effect, the mechanism proposed to underlie nonconscious mimicry is still poorly understood. The primary implication that the perception-behaviour link is the mechanism driving mimicry behaviour has been the suggestion that mimicry is an automatic effect. However, the automatic status of mimicry has been demonstrated by retrospective self-report alone to show the effect occurs without awareness (Chartrand & Bargh, 1999). It remains unclear whether nonconscious mimicry operates without awareness under more direct examination, and whether the mimicry effect exhibits the other three criteria of automaticity. Given that the unawareness criterion has been the primary characteristic within the mimicry literature to assert the effect's automaticity and the reservations discussed above with regards to how this has been previously demonstrated, the current thesis aims to apply the feature-based approach (Moors and De Houwer, 2007) to directly examine the role of awareness in mimicry behaviour. Additionally, mimicry has been proposed to serve a beneficial socially functional role, thus, one would speculate that in such social situations the mimicry effect

would be most advantageous if it was efficient in nature. For instance, social interactions can be taxing (Gilbert, Pelham & Krull, 1988), with individuals attending to multiple aspects of their environment, so to be beneficial mimicry behaviour would not be expected to draw on further attentional resources. For this reason, the current thesis also aims to directly examine the efficiency of mimicry behaviour. The remaining two automaticity criteria, specifically intention and control, present an issue in applying the feature-based approach. Namely, there may not be sufficient independence between these two automaticity criteria to examine them individually, as with the awareness and efficiency criteria. Moors & De Houwer (2007) outline these two criteria as sub-classes of each other, in that an intentional act is controlled because of the goal to alter behaviour and to engage in that act. Although the intention and control criteria are discussed in more detail with regards to mimicry in Chapter six, for the reasons stated above the subsequent empirical chapters will focus on investigating whether mimicry operates without awareness and with high efficiency.

Toward a better understanding of the conditions under which nonconscious mimicry occurs and the nature of the effect, the subsequent chapters will aim to examine three main research questions. Firstly, can nonconscious mimicry be reliably demonstrated when implementing an experimentally equivalent control condition? Secondly, do characteristics of the target gestures themselves, such as gesture type and amount of exposure, influence the degree to which nonconscious mimicry is expressed? Lastly, does nonconscious mimicry exhibit automatic properties when the criteria of the effect's automaticity are directly assessed individually in turn?

In order to address these questions Chapter Two describes a preliminary pilot study and a two-part experiment aimed to identifying suitable gestures to investigate the generalisability of mimicry behaviour. This includes the development of a reliable video based mimicry paradigm that can be employed to investigating the mimicry effect when implementing a well characterised control group in subsequent experiments. Chapter Three reports two experiments that investigate the effect of two perceptual factors, namely the exposure duration and gesture type of the target gestures, on the magnitude of mimicry expressed. Chapter Four reports two experiments that examine the automatic nature of mimicry, specifically, by directly testing the efficiency criterion of the effect. Chapter Five presents one experiment that continues the investigation of mimicry's automaticity by

examining the awareness criterion in relation to nonconscious mimicry. Lastly, Chapter Six provides a summary and interpretation of the results across the six experiments, considers the implications of these findings within the current mimicry literature, and assesses the limitations of the present research and possible future research.

Chapter Two:

Development of a Nonconscious Mimicry Paradigm

2.1 Introduction

The nonconscious mimicry literature has clearly demonstrated that individuals show the tendency to mimic or copy the gestures of an interaction partner (see Chartrand & Dalton, 2009 for review). However, there has been little specification as to how this effect occurs. In particular, the parameters of the characteristics of the target gestures that evoke mimicry behaviour, and the mechanisms underlying the effect, are poorly understood. In order to investigate these questions, however, a paradigm for assessing mimicry behaviour must be established. This forms the basis of the present chapter. As background to this, in the next section I will revisit a number of issues described in Chapter One, including the manner with which target gestures are presented in a typical mimicry paradigm, the presence of a control condition and the type of gestures used.

2.1.1 Mimicry Paradigm

When researchers have examined an individual's tendency to mimic the behaviour of an interaction partner the following paradigm has typically been employed. Participants complete an interaction based task with a confederate or pre-video recorded actor, who performs a target gesture of interest, such as face-rubbing. During these experimental tasks all participants are exposed to the confederate or actor performing the target gesture and the amount of target behaviour expressed by participants is measured as nonconscious mimicry. In order to develop a mimicry paradigm for use in this thesis, there are several aspects of the typical mimicry paradigm that need to be considered. The first of these is the manner in which gestures are presented.

2.1.1.1 Live Versus Pre-Recorded Confederates

Mimicry research has predominantly used live interactions, during which a confederate is physically present and performs target gestures throughout an interaction with a participant (Castelli, Pavan, Ferrari, & Kashima, 2009; Cheng & Chartrand 2003; Johnston, 2002;

Karremans & Verwijmeren, 2008; Lakin & Chartrand, study 2, 2003; Lakin, Chartrand, & Aarts, 2008; van Baaren, Maddux, Chartrand, Bouter, & van Knippenberg, 2003b; van Baaren, Horgan, Chartrand, & Dijkmans, study 2, 2004a). To a lesser extent, a pre-recorded video stimulus presenting an actor performing target gestures has been used to measure the degree to which participants mimic the behaviour of the actor in the video stimulus (Lakin & Chartrand, study 1, 2003; Parrill & Kimbara, 2006; Stel, Blascovich, McCall, Mastop, van Baaren, & Vonk, 2009; van Baaren et al., study 1, 2004a; van Baaren, Fockenberg, Holland, Janssen, & van Knippenberg, 2006; Yabar, Johnston, Miles, & Peace, 2006). Both live and video stimulus based interactions have previously demonstrated mimicry behaviour. There are, however, several advantages and disadvantages to each approach.

Arguably, the use of a live confederate is advantageous because it provides a more naturalistic simulation of a social interaction, which mimicry behaviour is purported to be important in facilitating (e.g., Chartrand & Bargh, study 2, 1999; Cheng & Chartrand, 2003). However, similar effects of the influence of interpersonal factors, such as group membership (Yabar et al., 2006) and affiliation goals (Lakin & Chartrand, study 1, 2003) on mimicry behaviour have been demonstrated using video stimulus as a means to present target gestures.

One disadvantage to the live confederate approach is the inconsistency with which target gestures are presented to participants when measuring mimicry behaviour. As discussed in Chapter One, there is a lack of clarity in the mimicry literature on the specific manipulations employed to elicit mimicry behaviour. These include estimates for the duration of exposure to target gestures between participants (e.g., Chartrand & Bargh, 1999; Cheng & Chartrand, 2003; van Swol, 2003), or reporting the overall frequency the target gestures are presented to participants as 'continuous' (e.g., Cheng & Chartrand, 2003; Lakin & Chartrand, study 2, 2003; Lakin et al., 2008). These issues likely stem from difficulties in keeping the relatively open ended tasks typically used (e.g., photo-descriptions and informal interviews) to a uniform duration, while making the interaction seem natural, as well as from the inherent difficulty of a confederate performing the exact same frequency of gestures with each participant across a study.

The use of video stimulus, in contrast, addresses many of the consistency issues discussed above. Using the same set of stimulus videos across participants ensures that all participants who are exposed to the target gestures see the same frequency, duration and quality (e.g., the same set of actual movements) of behaviour. Thus, the video stimulus approach offers greater control and precision over the manipulation of the target gestures compared to using a live confederate. This is crucial for examining the perceptual factors of the target gestures being presented and the way that these factors influence mimicry behaviour, as anticipated later in the thesis.

The discussed benefits of employing a video based mimicry paradigm to present target gestures to participants seem to outweigh the naturalistic interaction approach provided by using a live confederate. Thus, the current chapter will aim to establish a mimicry paradigm that can be used throughout this thesis using the video stimulus approach. However, there are other concerns with the typical mimicry approach: specifically, the absence of a control condition.

2.1.1.2 Appropriate Controls

As outlined in Chapter One, the common mimicry paradigm measures the difference in participants' tendency to express target gestures as a function of different moderating variables (e.g., Lakin & Chartrand, study 1, 2003; van Baaren et al., study 2, 2003b; van Baaren et al., 2004a; Vrijssen, Lange, Becker, & Rinck, 2010). It is unclear from this type of design the extent to which this behaviour has changed from pre-study gesturing levels. One approach to account for participants' normal level of expressing the target gesture of interest has been to take a baseline measure of behaviour prior to the task in which mimicry is measured.

Baselines

This baseline measure is typically a one minute period prior to exposure of the target gestures in which the participants normal tendency to express the target gestures are measured (Chartrand & Bargh, study 1, 1999; Cheng & Chartrand, 2003; Lakin & Chartrand, study 2, 2003; Lakin et al., 2008; van Baaren, Holland, Steenaert, & van Knippenberg, 2003a; van Baaren et al., study 3, 2003b; Yabar et al., 2006). Participants' behaviour expressed during this baseline measure is then generally used as covariate within

the behavioural mimicry analysis to account for the individual differences of target behaviour expressed. This measure has been used relatively infrequently within the mimicry literature and, even when it is used, it is not without problems.

One such issue is that the one minute measure of participant behaviour in the mimicry literature is not experimentally similar to the period in which actual mimicry behaviour is measured. This includes dissimilarities in the amount of time behaviour is measured for and differences in the social interaction context. Specifically, within the pre-experimental baseline measure participants are left alone in the testing room for one minute and asked to wait for the experimenter to return. In contrast, when mimicry behaviour is being measured participants are involved in an interaction style task for five (e.g., Cheng & Chartrand, 2003) to twenty minutes (e.g., Chartrand & Bargh, 1999) either with a live confederate or watching a confederate by video. Thus, participant behaviour expressed during the baseline and experiment periods may not be directly comparable.

A second issue with regard to the baseline measure is the way that it is applied and proposed to be a type of control measure. Returning to the example of paradigms that examine the influence of moderating variables on mimicry behaviour, the pre-experiment baseline measure only accounts for within-participant variability in behaviour. Although this may be expected to account for habitual behaviour to some degree, this does not measure and is not used to directly compare changes in behaviour between groups. Importantly, because the baseline measure is generally used as a covariate rather than a stand-alone variable, it is uncertain whether either group in this type of between-participant design displays target gestures above the rate that they are naturally expressed. Instead, an experimentally similar control condition would enable the direct comparison of changes in behaviour based on the absences or presence of a target gesture.

Control Conditions

A second approach to an experimental control condition has been to directly compare the relative change in behaviour between two target gestures within a similar interaction context (Chartrand & Bargh, 1999; van Baaren, et al; study 1, 2003b). While this does suggest that the participant's behaviour changed as a function of the confederate's behaviour between these two gestures, there are issues of directly comparing the relative

change in behaviour between two target gestures. Specifically, the likelihood of these two target gestures co-occurring is unclear, as is the extent to which they can occur independently of each other. For instance, a participant's mimicry of a confederate's face-rubbing behaviour may suppress the expression of foot-shaking behaviour, or other behaviour in general. If this were the case, it would imply the relative difference in face-rubbing and foot-shaking behaviour used to demonstrate nonconscious mimicry would be artificially greater than the typical expression of the two gestures. A cleaner behaviour comparison to demonstrate mimicry would be to show the amount of target behaviour expressed by participants increases when observing a target gesture, compared to the amount that behaviour is expressed when there is no opportunity to mimic.

To date, van Baaren and colleagues (2006) are the only researchers to employ this type of comparison using an experimentally similar behaviour control group. Notably, the authors found that nonconscious mimicry only occurred above control levels (e.g., behaviour expressed when exposed to no gestures) under certain conditions (van Baaren et al., 2006). Further examination of mimicry against a control condition is warranted. Moreover, from this type of design the potential issues discussed regarding previous paradigms that directly compare participant's expression of two different gestures (Chartrand & Bargh, 1999; van Baaren et al., study 1, 2003b) could be explored. Namely, this design allows for the examination of whether two target gestures to co-occur when expressing mimicry behaviour and the possibility that some gestures are more readily mimicked than others.

2.1.1.3 Specific Gestures Used in Mimicry Paradigms

In demonstrating nonconscious mimicry, research has predominantly employed the same two gestures: face-rubbing and foot-shaking (e.g., Chartrand & Bargh, 1999; Cheng & Chartrand, 2003; van Baaren et al., study 1, 2006; Vrijksen et al., 2010; Yabar et al., 2006). However, other non-gesture related mannerisms have been less frequently used, such as playing with a pen (Stel et al., 2009; van Baaren et al., study 2, 2006; van Baaren et al., study 2, 2003b) and eating (Johnston, 2002). The demonstration of mimicry across a variety of contextual situations and paradigms suggests that the effect is relatively robust. Thus, mimicry behaviour would be expected to generalise to a wider range of behaviours. Theoretically, the perception-behaviour link would support this notion. If the perception of face-rubbing behaviour activates the behavioural representation of that gesture, leading to

the increased tendency to express face-rubbing behaviour (Dijksterhuis & Bargh, 2001), then a similar effect should occur across numerous other common gestures. This degree of generalisability is consistent with the research in other prime-to-behaviour effects, such as automatic trait and stereotype priming (Bargh, Chen, & Burrows, 1996; Dijksterhuis & van Knippenberg, 1998) and imitation effects (Craighero, Bello, Fadiga, & Rizzolatti, 2002; Gillmeister, Catmur, Liepelt, Brass, & Heyes, 2008; Kilner, Paulignan, & Blakemore, 2003) suggested to be driven by a similar perception-behaviour link mechanism. In view of this, one potential approach to explore the generalisability of nonconscious mimicry would be to use a range of common gestures within the developed mimicry paradigm.

2.1.2 Development of a Mimicry Paradigm

Based on the discussion of previous mimicry paradigms in Chapter One it can be seen that typical mimicry paradigms use real-life interactions, with confederates performing face-rubbing and foot-shaking behaviour, and often have no experimentally comparable control condition. Regarding the advantages and disadvantages of each of these properties of mimicry paradigms discussed above it was decided that the mimicry paradigm used in this thesis should have the following features:

- 1) Employment of a video based paradigm, to provide greater experimental control for presenting target gestures aimed to elicit mimicry behaviour.

- 2) Use of an experimentally similar control condition, against which gesturing behaviour can be compared. Integrating a condition in which the actor presented in the video based task performs no gestures to directly assess levels of mimicry behaviour was measured in both within- and between-participants paradigms. These two approaches allowed, first, for each participant to provide their own baseline (e.g., target gestures absent), against which increased instances of target behaviour when that behaviour is present in the video can be compared (Experiment 1a). Alternatively, the between-participants comparison (Experiment 1b) has the potential to be utilised in designs where it is necessary to look at factors, such as moderators, across participants.

3) Extension of previous findings on mimicry behaviour of face-rubbing and foot-shaking to explore whether mimicry generalised to other commonly observed gestures. In order to identify such gestures, a pilot study was conducted to examine the frequency in which the target population (UK undergraduate students) tend to express a number of common gestures on a daily basis.

2.2 Pilot Study

A pilot study was designed to identify additional target gestures to add to those typically used in the mimicry literature (face-rubbing and foot-shaking; e.g., Cheng & Chartrand, 2003; Karremans & Verwijmeren, 2008; Lakin et al., 2008). The present pilot study aimed to establish the frequency with which a variety of gestures were reported to occur in a UK undergraduate population, including the typically used target gestures. Two frequently occurring gestures were chosen to maximize the likelihood of demonstrating mimicry. Furthermore, the pilot study aimed to check that the new gestures were approximately comparable to the gestures used in previous nonconscious mimicry research (face-rubbing and foot-shaking).

Face-rubbing and foot-shaking are classified as adaptor gestures. These gestures do not convey a specific non-verbal meaning, nor do they enhance a verbal message when co-occurring with speech (Ekman & Friesen, 1969). To identify two additional gestures that are comparable to face-rubbing and foot-shaking, only adaptor gestures were included in the pilot study. The adaptor gestures that participants were asked to rate were taken from a list reported by Mehrabian and Friedman (1986).

Thirty undergraduate psychology students (25 females, 5 males; age $M = 21.30$, $SD = 2.47$) rated 15 gestures, such as nose-rubbing, crossing their arms, touching their hair (see Appendix 1 for all gestures) on how regularly they performed them during an average day. Ratings for each gesture were averaged across participants (see Table 2.1). As there were several components of face-rubbing within the gestures; cheek-rubbing, forehead-rubbing, nose-rubbing, and resting of the chin in the hand were averaged to give an overall face-rubbing measure.

Table 2.1

Mean Ratings for the Regularity the Piloted Gesture Were Performed with Higher Ratings Indicating Greater Regularity (and the Composite Measure of Overall Face-Rubbing)

Gesture	Mean	SD
Overall face-rubbing	3.69	1.02
Cheek-rub	2.53	1.50
Scratch trunk of body	3.00	1.49
Rub forehead	3.10	1.73
Rub neck	3.23	1.61
Knee-bounce	3.43	1.89
Ear-touching	3.50	2.05
Nose-rubbing	3.80	1.83
Purse lips	4.03	1.79
Foot-shake	4.63	1.77
Tuck hair behind ears	4.97	1.99
Cross arms	5.33	1.45
Rest chin in hand	5.33	1.52
Play with pen	5.63	1.35
Cross legs	5.77	1.25
Hair-touching	6.07	1.08

One key consideration in choosing a pair of gestures to compare with the typical mimicry gestures was that the gestures selected needed to match well with the upper/lower body division of the face-rubbing and foot-shaking gestures. To match the foot-shaking gesture, the crossing of one's legs was considered since it was rated as being most frequently performed in the lower half of the body ($M = 5.77$, $SD = 1.25$) and was relatively similar to the ratings for foot-shaking behaviour ($M = 4.63$, $SD = 1.77$). However, two potential problems arose with this gesture. Firstly, crossing one's legs is generally a behaviour performed once (i.e. people do not repeatedly cross and uncross their legs within a short time frame). Therefore, the leg crossing gesture was discounted as, unlike foot-shaking, it could not be performed continuously. Secondly, there was the possible confounding factor that leg crossing and foot-shaking could co-occur. Foot-shaking may only occur when one's legs are crossed. The interdependence of the two gestures would weaken the argument that mimicry generalizes to alternative gestures, if mimicry was demonstrated. Therefore, knee-bouncing was selected as the new lower body gesture. Although knee-bouncing was not rated to be performed as often on a daily basis ($M = 3.43$, $SD = 1.89$) as leg crossing, it was relatively similar to ratings for foot-shaking behaviour. As a result, knee-bouncing was chosen as a match for the replicated foot-shaking gesture.

For a match to the face-rubbing gesture, hair-touching was reported as being performed the most frequently of all the gestures rated and , therefore, provided a strong candidate as a frequently performed gesture within the target population. Although the ratings suggest that face-rubbing ($M = 3.69, SD = 1.02$) is not expressed as often, on average, as hair-touching ($M = 6.07, SD = 1.08$), this may be due to the fact that face-rubbing was created as a composite measure. For example, the specificity of the face related gestures that were included in the questionnaire could have led to lower frequency ratings than if participants were asked to rate incidence of face-rubbing in more general terms. However, given the high frequency rating of the hair-touching expression, it was chosen as an upper body match for the face-rubbing gesture. In addition, the practicalities of coding participants' gestures were also considered. The four gestures identified (face-rubbing, foot-shaking, hair-touching and knee-bouncing) were reasonably independent of each other and discernibly different enough to be coded as four separate behaviours.

2.2.1 Development of the Stimulus Videos

Data from the pilot study was used to develop the initial stimulus videos for the gesture conditions in Experiment 1a. Four different videos were recorded in which a female student actor narrated two similar 'day in the life' stories (see Appendix 2), whilst sitting in a chair with her entire body visible. Prepared scripts were provided for the actor on cue cards to read from while recording. However, the actor rehearsed and narrated the stories to give the impression that she was naturally talking about a previous scenario in which she described working at home and finishing a project in the library. The two stories included mention of a number of common objects (e.g., pen, paperclip), which participants were instructed to remember for a subsequent recall test. Previous research employing video stimulus to present target gestures to participants have used a memory based task as a cover story for the true aim of the experiment (Lakin & Chartrand, study 1, 2003; van Baaren et al., study 1, 2004a; van Baaren et al., 2006). Both stories were narrated with the actor adopting a neutral body position and performing no gestures; these acted as the control stimulus videos.

As discussed in the introduction, researchers have not typically reported a precise count of target gestures presented to participants within the mimicry literature. In a personal

communication with Jessica Lakin (2008; Lakin is a key author in nonconscious mimicry research), it was suggested that the presentation of target gestures should be relatively frequent. However, it was important that these target gestures were not presented too often or intensely as to elicit conscious awareness from the participants. In Lakin’s paradigm when face-rubbing was manipulated, the gesture was performed by a pre-recorded actor every two to three seconds. In line with this suggestion, the actor in the present experiment was video-recorded narrating one story performing face-rubbing frequently (49 touches per minute) and continuous foot-shaking (137 times per minute). The second story was recited while the actor performed hair-touching (35 times per minute) and continuous knee-bouncing (124 times per minute) (see Figure 2.1).

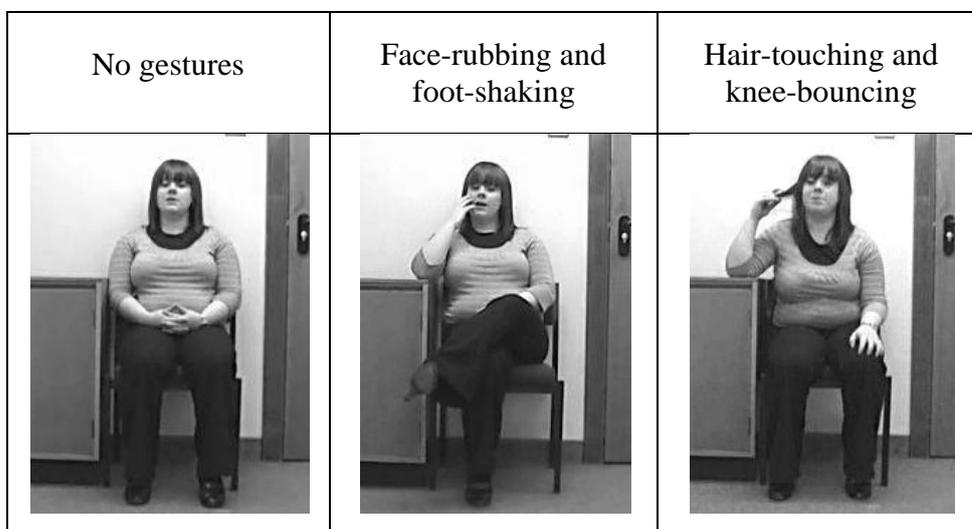


Figure 2.1. Example stills from the recorded stimulus videos in which the actor performed no gestures, face-rubbing and foot-shaking or hair-touching and knee-bouncing.

The actor was instructed to perform the target gestures continuously throughout her narration. Specifically, she did not perform the gestures at fixed time intervals or at predetermined points in the script. Primarily, the near continuous display of target gestures was intended to maximise the chance of observing mimicry behaviour above control (no gesture) levels. To reiterate, four different stimulus videos were recorded: two no gesture videos (narrating the working at home and library project stories), one face-rubbing and foot-shaking gesture video (narrating the working at home story) and one hair-touching and knee-bouncing gesture video (narrating the library project story). After the recording session all four videos were edited to two minutes in length.

2.3 Experiment 1a

2.3.1 Overview

The aim of this experiment was to establish a paradigm to demonstrate nonconscious behavioural mimicry. Participants' behaviour was measured when exposed to the target gestures performed by an actor and when exposed to the same actor adopting a neutral body position (i.e. performing no target gestures). Additionally, this experiment aimed to both replicate and extend the mimicry effect by using the replicated gestures, face-rubbing and foot-shaking (e.g., Chartrand & Bargh, 1999), and the piloted gestures, hair-touching and knee-bouncing, within the video based paradigm. It was predicted that the incidence of target gestures expressed by participants would be significantly higher when exposed to the target gestures compared to behaviour expressed in the no gesture, control condition. This pattern was expected for both the replicated and piloted gestures.

2.3.2 Method

2.3.2.1 Participants and Design

Forty-two undergraduate psychology students (40 females, 2 males; age $M = 21.43$, $SD = 5.83$) were randomly allocated to a 2 (gesture type: replicated gestures vs. piloted gestures) x 2 (gesture condition: no gestures vs. target gestures) x 2 (video order: gestures shown first vs. gestures shown second) mixed design, with gesture condition as the within-participant factor and the remaining two factors between-participants. Participants received partial course credit as payment for participation.

2.3.2.2 Procedure

Each participant was met at the laboratory by a female experimenter and tested individually. A video camera, which was placed in the corner of the room allowing for an unobstructed view of the participants entire body, was used to record participant's behaviour throughout the experiment. Participants were given the cover story that the study was examining differences in memory recall when information was presented by videotape versus receiving the same information in person, and that they had been placed in the videotape group. The recall component (i.e. remembering items mentioned from the story in the video) was designed to both provide a cover story for the experiment, and to ensure

that participants attended fully to each video. All participants were seated approximately five feet from a computer monitor (0.38 m x 0.33 m). It was explained that they would be watching two separate video clips of a student narrating two stories and completing a recall task after each video. Specifically, they would be given a minute and a half to recall and write down as many of the common objects, such as ball or cup, as possible from each story.

Participants were shown two videos, one with the actor performing the target gestures (either face-rubbing and foot-shaking, or hair-touching and knee-bouncing) and one with the actor performing no gestures (one of two no gesture videos containing the story that was not heard in the target gesture video). The order of the no gesture and target gesture video, and the type of gestures seen (replicated or piloted), was counterbalanced across participants. Half of the participants saw the replicated gestures (i.e. the actor rubbing her face and shaking her foot) in the gesture video, whereas the other half saw the piloted gestures (i.e. the actor touching her hair and bouncing her knee). After starting the first stimulus video, the experimenter was seated in the corner of the room out of the visual field of the participant, maintaining a neutral body position. This was done to avoid the possibility of the experimenter's behaviour influencing the participant's gesturing behaviour. At the end of the video, participants were given an object recall form and after a minute and a half the form was collected and the second video was started, in which the same procedure was followed. Participants then completed a funnelled debrief questionnaire, were fully debriefed, and thanked for their time.

2.3.2.3 Dependent Measures

Object Recall

Participants were given two identical object recall forms, which had 16 blank spaces on an A4 sheet, to write in the objects that they remembered from the video clips. This was in keeping with the cover story presented to the participants. In addition, it provided a means of checking whether participants were attending to the video and if this was influenced by the type of gesture shown.

Awareness Check

A funnelled debrief form (see Appendix 3) was adapted from the procedure outlined by Bargh and Chartrand (2000). Since nonconscious mimicry is proposed to be an automatic, nonconscious effect participants should report no awareness of their own mimicry behaviour and little to no awareness of the actor's performance of the target gestures. The funnelled debrief assessed participants' awareness of the actor's behaviour and possible suspicions as to the true nature of the study. For example, participants were asked a series of questions, starting in broad terms such as "What do you think the purpose of this experiment was?". Each subsequent question tapped into more specific areas of the true aim of the study, for example, "Did you notice any particular pattern or theme of the behaviour shown by the person in the video?".

Participant Behaviour

The video-recorded experiment sessions were used for later coding of participants behaviour. To create a coding scheme for participant behaviour, scoring of gestures expressed was based on the gestures displayed by the actor. In the video containing the replicated gestures the actor only exhibited face-rubbing within the oval of the face from the jaw line up to the forehead. Foot-shaking was performed with the legs crossed at the knee, with the foot of the top-crossed leg tapping or shaking. In the video where the piloted gestures were performed, the actor exhibited hair-touching from the scalp to the full length of her hair. Knee-bouncing was shown with both feet on the ground and the leg raised on the ball of the foot. Accordingly, behaviour expressed by participants was coded as a target gesture only if it was within the gesture areas stipulated above.

Following this coding scheme, participant behaviour was coded from the recorded sessions using Noldus behaviour observation software (The Observer, 2003). The frequency with which each participant displayed face-rubbing, foot-shaking, hair-touching and knee-bouncing behaviour was blind-coded. The frequency score for each gesture was divided by the number of minutes of the video presentation and object recall tasks, which yielded a frequency per minute gesture score for each of the four target gestures per participant. The duration in which mimicry behaviour was measured was over a seven minute period. This was broken down into two sessions, the first included participants watching the first video

and completing the subsequent item recall task. The second session included the second video being shown and the item recall task pertaining to the second video.

2.3.3 Results and Discussion

Awareness Check

Participants' response to the awareness check was analysed to confirm that any mimicry behaviour observed occurred without participants' awareness of the effect. In response to the questions, "Did you notice anything unusual about the person presenting the stories?" and "Did you notice any differences in the person's behaviour across the two videos?", 66.6% (26 of the 39 participants) were aware of the contrast in the behaviour of the actor between the gesturing and the no gesturing video sessions, and were able to explicitly state the target gestures. Notably, the number of participants explicitly reporting the target gestures was higher than expected. This will be addressed in relation to participant behaviour in the discussion section below.

2.3.3.1 Behavioural Mimicry

Coding of participant video data revealed that only one participant displayed knee-bouncing behaviour using the coding criteria outlined above. As a result, this gesture was discarded from further analysis and each of the three remaining behaviours was examined separately. Two participants were excluded due to equipment malfunction.¹ Exploratory analysis revealed that violations of normal distribution for the face-rubbing, foot-shaking and hair-touching gestures. Thus, the behavioural data was checked for outliers 2.5 standard deviations above the mean gesture expression for each of the three gestures separately (Upton & Cook, 2008; van Baaren et al., 2006). One participant was identified as a statistical outlier in the hair-touching behavioural data and was removed from the behavioural analyses and all behavioural data was Log10 transformed (Field, 2005), which corrected distribution violations. Thus, data from 39 participants were included in the final analyses.

¹ The video camera failed to record these participant experiment session.

Face-Rubbing Behaviour

A 2 (gesture condition: no gestures vs. target gestures) x 2 (video order: gestures shown first vs. gestures shown second) mixed ANOVA with the gesture condition as the within-participant factor was conducted on participants' face-rubbing behaviour. This included only participants who were shown the replicated gestures video ($N=19$). Analysis revealed no main effect of gesture condition, $F(1, 17) = 1.70, p = .21, f^2 = 0.32^2$, no main effect of video order, $F < 1, p = .89, f^2 = 0.03$, and a no significant interaction between the gesture condition and video order, $F < 1, p = .45, f^2 = 0.19$ (see Table 2.2).

Foot-Shaking Behaviour

The same analysis was run on participants' foot-shaking behaviour including only those who were shown the replicated gestures. Results showed no main effect of gesture condition, $F < 1, p = .79, f^2 = 0.06$, no main effect of video order, $F < 1, p = .80, f^2 = 0.06$, and a marginal interaction between the gesture condition and video order, $F(1, 17) = 3.80, p = .07, f^2 = 0.47$ (see Table 2.2). Exploratory analysis investigated the two video order sessions separately for within-participant differences in rate of foot-shaking behaviour while watching the no gesture video and the replicated gesture video. Paired-sample t-tests showed that neither those who saw the replicated gestures video first, $t(7) = 0.54, p = .61, d = 0.30$, nor those who saw the gesture video second, $t(6) = 1.49, p = .19, d = 0.55$, significantly changed their behaviour relative to behaviour expressed during the no gesture video.

Hair-touching Behaviour

The same mixed ANOVA was conducted on participants' hair-touching behaviour, which included only participants who were shown the piloted gestures video ($N=20$). Analysis revealed no main effect of gesture condition, $F(1, 18) = 1.00, p = .33, f^2 = 0.23$, no main effect of video order, $F < 1, p = .92, f^2 = 0.06$, and no significant interaction between the gesture condition and video order, $F < 1, p = .44, f^2 = 0.19$ (see Table 2.2).

² This and all subsequent effect sizes were calculated using G*Power statistical software (Faul, Erdfelder, Lang, & Buchner, 2007).

Table 2.2

Mean Participant Behaviour when Gestures were Absent and when the Corresponding Gestures were Present in the Video

	No Gestures in video	Gestures present in video
Face-rubbing	2.40 (2.10)	1.74 (1.34)
Foot-shaking	1.46 (2.98)	1.32 (3.16)
Hair-touching	0.24 (0.33)	0.18 (0.24)

Note: Analyses were run on Log10 based transformed data, but all means (SD) reported are the frequency per minute expression of target gestures.

2.3.3.2 Object Recall

A 2 (gesture type: replicated gestures vs. piloted gestures) x 2 (video order: gestures shown first vs. gestures shown second) between-participants ANOVA was run on the number of objects participants were able to recall. Analysis revealed no main effect of gesture type, $F(1, 38) = 2.89, p = .10, f^2 = 0.28$, no main effect of the order participants saw the videos, $F(1, 38) = 2.52, p = .12, f^2 = 0.26$, and no significant interaction between gesture type and video order, $F < 1, p = .42, f^2 = 0.13$. Overall, participants were able to recall $M = 8.34$ ($SD = 1.94$) objects across the two recall periods, out of 16 possible objects mentioned by the actor in each video. Thus, exposure to the replicated or piloted gestures, the order of gesture presentation and the type of story (e.g., working from home and library project) did not influence participants' ability to recall the objects from the stimuli video narratives.

2.3.3.3 Discussion

It was predicted that mimicry would occur significantly above the control levels in both the well-established face-rubbing and foot-shaking gestures, as well as extend to other commonly performed gestures, hair-touching and knee bouncing. However, analyses revealed that participants did not express an increase in target gestures, replicated or piloted, when they observed an actor performing these specific behaviours relative to when the actor performed no gestures. Thus, behavioural mimicry was not reliably demonstrated.

Due to the knee-bouncing gesture being discarded, the plans for analysing participants' behaviour had to be adjusted. It was anticipated that the replicated and piloted gestures would be examined in pairs since participants were concurrently exposed to face-rubbing

and foot-shaking or hair-touching and knee-bouncing. In contrast, the target gestures had to be analysed separately to avoid an unbalanced comparison of the replicated and piloted gestures. Participant numbers were relatively low in each gesture condition for this type of analysis, and this was seemingly reflected in the small to medium effect sizes (Cohen, 1992) observed. It is possible that the sample size collected was not adequate to detect the mimicry effect. However, across the three target gestures participants expressed numerically higher levels of target behaviour when shown the actor performing no gestures, relative to being shown the actor performing the target gestures. Participants' expression of the target gestures can only be termed mimicry behaviour if it occurs when perceiving the actor perform the target gestures. Thus, including additional participants to the tested sample would have been unlikely to increase the ability of Experiment 1a to detect the mimicry effect.

The results for the object recall measure suggested that participants were attending to the video. Although one possible interpretation of the object recall measure is that it may only provide evidence that participants attended to the auditory component of the stimuli videos, rather than the visual. In an attempt to address this issue, during the coding of participants recorded sessions in Experiment 1a (and all subsequent experiments in this thesis) all participants' gaze focus was visible to the coder and noted. Specifically, if a participant cumulatively spent over half of the video presentation closing or diverting their eyes away from the computer screen, then they were removed from all subsequent analyses. Importantly, no participant in Experiment 1a displayed this behaviour. In addition, the recall scores did not differ based on the type of gesture (replicated or piloted) seen. This finding suggests that both the stories used to present the target gestures were relatively equal in terms of participants' ability to complete the recall cover task. Therefore, the fact that the narrated stories were not completely counterbalanced with gesture type (e.g., the replicated gestures were always performed by the actor narrating the working at home story, and the piloted gestures were always performed by the actor narrating the library project story) did not appear to be an issue.

Rather, the results obtained in the funnelled debrief provided some explanation for the lack of mimicry demonstrated. The funnelled debrief revealed that participants reported a high level of awareness of the gestures. Although it is common to remove participants from analysis who report this type of awareness or suspicions about the cover story (Bailenson

& Yee, 2005; Chartrand & Bargh, 1999; Lakin et al., 2008; van Baaren et al., 2003a), this typically results in the removal of a small number of participants. In the current experiment, this would have meant the removal of over half (26 out of 39) of the tested population. Furthermore, that such a high proportion of participants were reporting awareness of the gestures suggests that there is a problem with the mimicry paradigm. Given that mimicry is supposed to operate without awareness, it is possible that participants' conscious awareness of the actor's behaviour, as reported in the funnelled debrief, could have potentially disrupted or inhibited nonconscious mimicry behaviour.

Considering the participants' expression of the target gestures in relation to the pilot study, participants appeared to express higher levels of face-rubbing behaviour than foot-shaking at control levels, as highlighted in Table 2.2. It is possible that face-rubbing is simply displayed more frequently than foot-shaking behaviour. However, this is inconsistent with the self-reported frequencies obtained in the pilot study. Likewise, the hair-touching gesture was rated as most frequently performed in the pilot study. However, the direction of means suggested hair-touching was expressed at lower levels than face-rubbing and foot-shaking consistently across both stimuli video study sessions. Moreover, the knee-bouncing gesture was expressed at floor levels and was not applicable to include in the final behavioural analyses in the present experiment, whereas knee-bouncing was rated as more frequently performed than general face-rubbing behaviour in the pilot study. Together, these results suggest that the self-report measure of the typical frequency that gestures are performed did not appear to accurately reflect actual behaviour.

The finding that target behaviour was expressed at a higher rate in the no gesture conditions, together with the high level of awareness of the target gestures reported, suggests that refinement of the mimicry paradigm is necessary. The lack of nonconscious mimicry was potentially due to the gestures being too overt; in particular, because they were being performed at a near continuous rate by the actor in the stimulus videos. This level of awareness could have been further compounded by the within-participant design of the gesture factor. To address the latter possibility, Experiment 1b examined participants' behaviour when exposed to the actor performing no gestures or target gestures in a between-participants design.

2.4 Experiment 1b

2.4.1 Overview

In order to address the potential problems with the paradigm highlighted in Experiment 1a, Experiment 1b employed a between-participant comparison of the actor performing no gestures or the target gestures. It was expected that the between-participant design would result in a lower number of participants reporting awareness of the target gestures compared to Experiment 1a, as participants would not have the opportunity to compare gesture and no gesture conditions directly. In addition, this new design focused on the replicated gestures only (face-rubbing and foot-shaking). One would expect mimicry behaviour to generalise to the piloted gestures or any number of adaptor gestures. However, the face-rubbing and foot-shaking gestures were returned to as representative target gestures within the mimicry literature with the aim of demonstrating the mimicry effect. Examining the generalisability of mimicry will be further pursued in the next chapter. It was predicted that participants exposed to the replicated gestures would perform a higher rate of face-rubbing and foot-shaking behaviour than those exposed to no gestures, thereby demonstrating nonconscious mimicry.

2.4.2 Method

2.4.2.1 Participants and Design

Fifty-three undergraduate and postgraduate students (51 females, 2 males; age $M = 20.86$, $SD = 4.28$) were randomly allocated to a 2 (gesture condition: no gestures vs. target gestures) factor between-participants design. Nineteen participants from Experiment 1a who saw the replicated gestures were included using their behaviour in response to the first video they saw only, and 34 new participants were recruited who had not taken part in Experiment 1a. Participants received partial course credit or £3 as payment for participation.

2.4.2.2 Procedure

The same procedure and stimulus videos from Experiment 1a were used with the following exceptions. Participants saw only one of two videos, either of the actor performing face-rubbing and foot-shaking, or displaying no gestures.

2.4.2.3 Dependent Measures

Measures of object recall, awareness check, and participant behaviour were taken, all of which were identical to Experiment 1a.

2.4.3 Results and Discussion

Awareness Check

Analyses of the funnelled debrief showed that participants reported a high level of awareness of the gestures in the stimulus video. In response to the questions, “Did you notice anything unusual about the person presenting the story?” and “Did you notice any particular pattern or theme of behaviour shown by the person in the video?”, 47.1% (16 out of 34) of participants³ were able to explicitly list the target gestures.

2.4.3.1 Behavioural Mimicry

Exploratory analysis revealed that violations of normal distribution for the face-rubbing and foot-shaking behaviour expressed by participants. Two participants were identified and removed from all analyses as outliers 2.5 standard deviations above the foot-shaking frequency per minute mean (Upton & Cook, 2008; van Baaren et al., 2006), and all behaviour data was Log10 transformed (Field, 2005), which corrected distribution violations. As a result, 51 participants were included in the final analyses balanced across the gesture conditions.

Face-rubbing and Foot-shaking

A 2 (gesture condition: no gestures vs. target gestures) factor independent samples t-test was conducted on participants’ frequency per minute face-rubbing behaviour. Analysis showed no effect of the gesture condition on participants’ face-rubbing behaviour, $t(49) = 0.67, p = .51, d = 0.19$ (see Table 2.3). The same analysis was conducted on participants’ frequency per minute foot-shaking behaviour, revealing no effect of the gesture condition, $t(49) = 1.00, p = .32, d = 0.28$ (see Table 2.3).

³Analysis of funnelled debrief only included the participants who were tested using the one video session design. The participants who were included from Experiment 1a ($N=19$) were previously questioned on the actor’s behaviour across the two video sessions.

Table 2.3

Mean Participant Behaviour as a Function of Gesture Condition

	No Gestures in video	Gestures present in video
Face-rubbing	2.02 (1.92)	1.60 (1.46)
Foot-shaking	1.18 (2.40)	1.73 (2.80)

Note: Analyses were run on Log10 based transformed data, but all means (SD) reported are the frequency per minute expression of target gestures.

To directly compare the level that participants' expressed both face-rubbing and foot-shaking behaviour, a 2 (gesture: face-rubbing vs. foot-shaking) paired-samples t-test was conducted. Since previous analyses revealed no significant effect of gesture condition, it was not pertinent to consider which gesture led to more mimicry. For this reason, the overall expression of these gestures was considered by collapsing across gesture condition. This analysis revealed that participants expressed significantly more face-rubbing behaviour ($M = 1.80$, $SD = 1.70$) than foot-shaking behaviour ($M = 1.46$, $SD = 2.60$), $t(50) = 2.86$, $p = .01$, $d = 0.40$, regardless of the actor's behaviour in the stimulus videos.

2.4.3.2 Object Recall

A 2 (gesture condition: no gestures vs. target gestures) independent samples t-test was conducted on the number of objects recalled. Participants who saw no gestures in the video were able to recall significantly more objects ($M = 9.81$, $SD = 1.79$) than those who saw face-rubbing and foot-shaking performed ($M = 7.74$, $SD = 2.64$), $t(49) = -3.32$, $p = .002$, $d = 0.92$.

2.4.3.3 Discussion

Contrary to the prediction that changing the paradigm to a between-participant design would lead to mimicry occurring above control levels, results of Experiment 1b indicated that nonconscious mimicry was not observed. Participants did not express a significantly higher rate of face-rubbing or foot-shaking behaviour when exposed to the gestures in the stimulus video, relative to those who were shown no gestures. In fact, the directions of mean face-rubbing behaviour showed that participants displayed a slightly higher rate of

face-rubbing when shown the actor performing no gestures compared to those who were shown the actor performing gestures. This tendency was reversed for participants' foot-shaking behaviour, although not significantly above no gesture levels. Interestingly, face-rubbing was performed to a greater extent than foot-shaking, replicating the pattern of behaviour from Experiment 1a. This lends further support to the possibility that face-rubbing behaviour may occur more frequently on a daily basis.

Regarding participants' awareness of the actor's gestures, a higher than expected percentage of participants explicitly named the gestures as unusual. These results indicate the high proportion of individuals reporting awareness of the actor's behaviour was not corrected by removing the comparison of seeing the actor perform target gestures and no gestures within-participant. This suggests that it is likely that there is a problem with the video stimuli created. Specifically, this indicates that the high rate with which the gestures were performed in the videos was the predominant cause for the high levels of awareness observed. Participants' object recall scores provided some support for this point. It is possible the unusually high salience of the target gestures led to decreased attentional focus to the object recall task, which resulted in the finding that participants shown no gestures were able to recall more objects than those shown the target gestures. However, this is a speculative explanation, especially since this difference in the object recall between the no gesture and target gesture stimulus videos was not found in Experiment 1a. Nevertheless, the results from the awareness check measure indicates that the stimulus videos employed contained an over saturation of target gestures, and this may explain the lack of nonconscious mimicry.

2.5 General Discussion

Experiments 1a and 1b sought to develop a reliable mimicry paradigm that could be employed to investigate the mimicry effect in subsequent experiments. The aim of this chapter was to improve on the existing mimicry paradigms. As such, experimental design changes were instituted: for example, the inclusion of an experimentally similar control condition. In addition to this aim, the chapter also intended to extend mimicry findings to alternative gestures. However, the video based paradigm developed did not produce nonconscious behavioural mimicry, either using the replicated gestures or piloted gestures. In terms of explaining this null finding, the results from the funnelled debrief across

Experiments 1a and 1b clearly showed that participants were routinely aware of the target gestures in the stimulus videos. In a review Chartrand (2005), hypothesised that if an individual becomes aware of the perceptual cues (e.g., target gesture) and the cues are unusual, negative or surprising, the cue is questioned. This has led to the speculation that once awareness occurs individuals have the ability to consciously control their behaviour, disrupting the automatic processes between perception and behaviour (Chartrand, 2005; van Baaren et al., 2009).

In the current chapter, the near continuous display of target gestures by the actor was reported by the participants when asked if they had noticed anything unusual in the awareness check measure. Furthermore, the behavioural means indicated that participants expressed the target gestures to a greater degree when shown the control, no gesture video (with the exception of foot-shaking behaviour in Experiment 1b). In line with the hypothesis put forward by Chartrand (2005), the high level of awareness of the actor's behaviour may have disrupted perception automatically influencing behaviour, leading to a decrease in mimicry of the target gestures relative to control levels.

In an attempt to address one source of the gesture awareness found in Experiment 1a, the design of the mimicry paradigm was altered in Experiment 1b, by using a between rather than within-participant manipulation of gesture. However, the new design did not have the expected results on participants' level of awareness or mimicry behaviour. Although nonconscious mimicry was not observed in Experiment 1b, the reported incidence of awareness declined slightly. There was also some evidence for mimicry of foot-shaking. Specifically, participants expressed a greater, albeit not significant, rate of foot-shaking behaviour when shown the actor performing the gesture compared to those who were shown the actor performing no gestures. This pattern of behaviour was reversed in Experiment 1a, which implemented the within-participant design.

The secondary aim of the chapter was to demonstrate the generalisability of nonconscious mimicry. The results indicated that neither of the two piloted gestures identified as occurring frequently in the target population were reliably mimicked. In fact, the self-report measure from the pilot study on how often participants expressed gestures on a daily basis did not predict participants actual behaviour in Experiment 1a. Although according to self-reports knee-bouncing was performed approximately as regularly as face-rubbing,

there was very little evidence of the gesture being performed in Experiment 1a. Similarly, hair-touching was rated highest on incidence of general expression, yet, was displayed far below the rate of face-rubbing or foot-shaking behaviour in the control condition. This discrepancy between reported and expressed behaviour may be due to the inability of individuals to accurately report habitual behaviour. A more direct method of measuring alternative gestures' relative frequency of occurrence is needed, such as measuring individuals' actual behaviour, to ensure target gestures employed to examine the generalisability of mimicry do not typically occur at floor levels.

Refinement of the Mimicry Paradigm

The stimulus videos were initially created with the actor performing a high amount of gestures to increase participants' exposure to the behaviours, with the aim of increasing the occurrence of mimicry. Contrary to this aim, the high frequency of the gestures in the stimuli developed here, may have been too frequent and, as such, may have inadvertently led to participants' awareness of the target gestures. It is currently unclear whether there is some threshold with which participants need to be exposed to target gestures in order to reliably demonstrate nonconscious mimicry. The findings in this chapter suggest that the gesture frequency in the stimulus videos needed to be reduced and highlight the need to better specify the role of gesture exposure to produce mimicry effects.

To examine the role of exposure, however, an appropriate target gesture needs to be selected. Face-rubbing was found to be more prevalently expressed at control levels by participants across both Experiment 1a and 1b. Furthermore, facial stimuli both capture and retain visual attention to a greater degree than non-face stimuli (Bindemann, Burton, Hooge, Jenkins, & de Haan, 2005). Notably, attention has been proposed to operate independently of awareness, such that the processing of incoming information via attention can occur unconsciously (Dijksterhuis & Aarts, 2010). This tendency toward greater attentional focus on the face may cause individuals to perceive and encode target gestures involving the face to a greater extent. This could potentially lead to greater activation of the mental behavioural representation of the perceived gesture, resulting in increased nonconscious behavioural mimicry. Accordingly, subsequent testing to both demonstrate nonconscious mimicry and the generalisability of the effect would benefit from manipulating gestures involving the face area.

The use of a within- or between-participants design to present target gestures also needs to be carefully considered. Presenting both the target gestures and no gesture videos within-participant had the benefit of enabling participants to provide their own baseline level of target gesture expression. This allowed for a more direct comparison of participant behaviour when exposed to the target gestures and no gestures that was not clouded by individual differences. It was speculated that the comparison of the target gesture and the no gesture video sessions in the within-participant design of Experiment 1a exacerbated the issue with high levels of awareness. The between-participants design employed in Experiment 1b showed a lower percentage of participants explicitly reporting the target gestures as unusual (47.1%), compared to the within-participant design used in Experiment 1a (66.6%). Furthermore, the between-participants design may be needed in later experiments to examine factors that cannot be manipulated in a within-participant design. However, if the between-participants design is to be kept within the refined mimicry paradigm, a pre-experiment baseline measure needs to be employed to help account for individual variation in gestures expression. Importantly, this baseline measure would act as a covariate factor for all participants, not act as a replacement for the control condition.

Although nonconscious mimicry was not observed in relation to an experimentally comparable control, it seems unlikely that such a pervasive effect would disappear under such conditions. Rather, the present experiments provided valuable insight toward the paradigm's development. This understanding will be applied to further develop the mimicry paradigm in the following chapter.

Chapter Three:

Nonconscious Mimicry and Gesture Presentation

3.1 Introduction

The previous chapter sought to develop a paradigm to assess nonconscious mimicry and to examine the generalisability of the effect. However, nonconscious mimicry was not demonstrated in relation to an experimentally comparable control (no gesture) condition; thus, these aims will be revisited in the current chapter. The evidence obtained in Experiments 1a and 1b suggested that there are several outstanding methodological issues that need to be considered in the development of a reliable mimicry paradigm. These include the experimental design employed, the experimental task used in the video based paradigm and the presentation of the target gestures. Each will be addressed below in order to identify a reliable mimicry paradigm to demonstrate nonconscious mimicry.

3.1.1 Refinement of the Mimicry Paradigm

Many of the methodological issues from the previous chapter stemmed from the high frequency with which the target gestures were presented to participants. There was some evidence that the highly salient non-verbal behaviour of the actor may have undermined the mimicry effect. Specifically, when participants were exposed to what they perceived as an unusual over-expression of gestures, this elicited awareness that was the probable cause of the absence of mimicry behaviour in Experiments 1a and 1b. It has been suggested that awareness of the perceptual cues triggering an automatic process can lead to individuals being able to consciously control their behaviour, disrupting the automatic processes between perception and behaviour (Chartrand, 2005). This assumption that awareness disrupts automatic processes remains untested with regard to nonconscious mimicry, although the results obtained in the previous chapter are in line with Chartrand's (2005) assertion. More importantly, this underscores the fact that the frequency with which the target gestures are presented to participants within the mimicry paradigm needs to be carefully considered. In addition, there were several methodological components of Experiments 1a and 1b that may have contributed to the absence of mimicry behaviour

observed; namely, the experiment design employed, the experiment task used as a cover story and an uncertainty as to how the actor was perceived by participants.

Experiment Design

The previous chapter employed both a within- and between-participants design in comparing participant behaviour expressed when exposed to the target gestures and when exposed to no gestures. The within-participant design has the advantage of allowing each participant to provide their own baseline behaviour (e.g., when exposed to no gestures), which can be compared with behaviour expressed when exposed to the target gestures. However, the results from Experiments 1a and 1b indicated that a greater percentage of participants reported awareness of the actor's behaviour in the within-participant design (e.g., 1a) compared to the between-participants design (e.g., 1b). One possible explanation for this difference was the use of the same actor across the two different video sessions in the within-participant design.

Researchers who have employed two different target gestures in a within-participant design have typically used two different confederates or actors to perform the different gestures (Chartrand & Bargh, 1999; van Baaren, Maddux, Chartrand, de Bouter, & van Knippenberg, 2003b; van Baaren, Fockenberg, Holland, Janssen, & van Knippenberg, 2006; van Swol, 2003). Specifically, one confederate performs one gesture, such as face-rubbing, and a second different confederate performs a gesture that the first did not, such as foot-shaking. In Experiment 1a, the use of the same actor to perform the target gestures and to perform no gestures in the within-participant design potentially made the change in behaviour more salient to participants. However, it is unclear whether employing the use of multiple actors in a within-participant design would reduce awareness when the contrast across conditions is between gestures and no gestures rather than different types of gestures (as employed elsewhere). For this reason, the between-participants design employed in Experiment 1b was retained as outlined below.

Adopting the between-participants design does not allow each participant to provide their own baseline behaviour, as in the within-participant design. To address this, a one minute pre-experiment baseline measure of participants' behaviour was introduced to the mimicry paradigm. This provided a baseline measure of participants' behaviour to account for

individual differences in behaviour. Notably, this type of baseline measure is common within the mimicry literature (Chartrand & Bargh, 1999; Cheng & Chartrand, 2003; Yabar, Johnston, Miles, & Peace, 2006; & Lakin, Chartrand, & Arkin, 2008), but has primarily been applied in place of a control condition in demonstrating mimicry's occurrence. In the current chapter, this pre-experiment measure was employed to gauge baseline levels of behaviour for participants in the control and target gesture conditions.

Cover Story Task Employed During the Measurement of Mimicry

Memory recall tasks, similar to the one employed in Chapter Two, have been previously employed in video based mimicry paradigms (van Baaren, Horgan, Chartrand, & Dijkmans, 2004a; van Baaren et al., 2006; Lakin & Chartrand, 2003). However, as nonconscious mimicry has been proposed to be important in facilitating social interactions (Chartrand & Bargh, study 2; 1999; Cheng & Chartrand, 2003), it is possible that the recall task did not engage participants in the same way that a more interactive task, such as a photo-description or informal interview task, would. The finding that both live and video stimulus based interactions have previously demonstrated mimicry behaviour suggests that a live interaction is not necessary for mimicry to occur (Lakin & Chartrand, study 1, 2003; Parrill & Kimbara, 2006; van Baaren et al., study 1, 2004a; van Baaren et al., 2006; Yabar et al., 2006). However, some researchers using a video-based paradigm have tried to make the interaction context more salient by informing participants that the recorded video is a 'live-feed', and the person in the video is a live participant in another room (Lakin & Chartrand, 2003; Yabar et al., 2006). This approach does introduce potential problems, such as the believability of the claim that a pre-recorded actor is in fact a live participant, which can result in the exclusion of a number of participants from a tested sample due to suspicions about the cover story (Lakin & Chartrand, 2003; Yabar et al., 2006). Thus, in an attempt to avoid this problem and introduce a task with interactive qualities, an adapted form of a photo-description task was employed. Furthermore, the photo-description task was chosen because it is one of the most commonly used tasks within the mimicry literature (e.g., Ashton-James, van Baaren, Chartrand, Decety, & Karremans, 2007; Chartrand & Bargh, 1999; Cheng & Chartrand, 2003; Lakin et al., 2008; van Baaren, Holland, Kawakami, & van Knippenberg, 2004b; Yabar et al., 2006) and has been validated to demonstrate mimicry behaviour.

Manipulation Checks for How the Actor is Perceived and Participants Affective State

Evidence from the previous chapter indicated that a large percentage of participants reported perceiving the actor's behaviour as unusual in the awareness check measure. Although it is likely that this finding was due to the high frequency with which the actor performed the target gestures, it is also possible that this led participants to perceive the actor negatively. Given the well documented relationship between reported liking of an interaction partner and nonconscious mimicry (Lakin & Chartrand, 2003; Lakin, 2006; Chartrand & Dalton, 2009), a measure of participants' perception of the actor in the stimulus videos was included as a refinement to the paradigm to ensure that a potential lack of mimicry was not explained by dislike for the actor.

In addition, research on the influence of mood on nonconscious mimicry suggests that individuals who reported feelings of negative affect (van Baaren et al., 2006) and elevated levels of anxiety (Vrijssen, Lange, Becker, & Rinck, 2010) tend to express lower instances of mimicry behaviour. Due to the nature of this mimicry paradigm, particularly participants' knowledge of being video-recorded, potential changes in emotional state during the experiment could partially account for the decreased levels of mimicry behaviour found in the previous chapter. Thus, measures of the valence and arousal dimensions of affect were collected. These dimensions measure the extent to which participants felt happy to unhappy (valence) and excited to calm (arousal) (Lang, Bradley, & Cuthbert, 1997).

Gesture Presentation

As discussed at the end of Chapter Two, face-rubbing behaviour appeared to be the most appropriate target gesture to demonstrate and further explore the mimicry effect. It was suggested that the high frequency per minute with which the gesture was presented (e.g., 49 times per minute), and the resulting participant awareness, was the most likely reason for not demonstrating mimicry in Experiments 1a and 1b. As a result, reducing the frequency with which this target gesture is presented to participants was considered necessary in refining the mimicry paradigm. As highlighted in the previous chapter, it is often unspecified in the mimicry literature the frequency that target gestures are presented

to participants to elicit mimicry behaviour. This makes it difficult to determine if there is an optimal frequency or rate of gesture presentation to demonstrate nonconscious mimicry.

At a broader level, this lack of clarity highlights an important and as yet untested question: to what extent do the perceptual characteristics, such as exposure duration, of target gestures influence nonconscious mimicry behaviour? The results from Chapter Two imply that exposure to a high frequency of target gestures may decrease or inhibit mimicry behaviour. Yet, it is currently unclear whether the degree of mimicry exhibited is predicted by the amount of gesturing to which a participant is initially exposed. Thus, a secondary aim of this chapter was to investigate whether the length of exposure to target gestures influences mimicry behaviour.

3.1.2 Duration of Exposure to Target Gestures

While it is unclear whether exposure to target gesture influences mimicry behaviour, some parallels can be drawn from the evidence provided by the automatic social priming literature. Research in automatic trait and stereotype priming suggests increased exposure to target constructs, both increased frequency of prime presentation (Devine, 1989) and prolonged duration of prime presentation (Dijksterhuis & van Knippenberg, 1998) predicted stronger behavioural effects of the primed constructs. Specifically, Dijksterhuis and van Knippenberg (1998) found that exposing participants to a negative stereotype, “soccer hooligans”, resulted in deteriorated performance on a general knowledge task compared to those who received a neutral prime. Importantly, those who were exposed to the stereotype prime for a nine minute period performed worse on the task relative to those exposed to the stereotype for two minutes. These findings demonstrate that greater exposure to primes, such as traits or stereotypes, may lead to an increase in the behaviour associated with the prime.

Automatic behavioural effects from trait and stereotype priming are proposed to share many of the same perception-behaviour link mechanism features as nonconscious mimicry (Dijksterhuis & Bargh, 2001). In nonconscious mimicry, the perception of a gesture is proposed to automatically activate the behavioural representation of the observed gesture, increasing the tendency to express that behaviour (Dijksterhuis & Bargh, 2001). In automatic trait and stereotype priming, perception of a trait, such as ‘kind’, can activate

mental constructs related with that trait that also include behavioural representations. Consequently, it is not the direct perception of a specific behaviour activating the behavioural representation, as in mimicry effects, which leads to automatic perception-to-behaviour effects (Wheeler & DeMarree, 2009). Thus, nonconscious mimicry and automatic trait and stereotype priming effects activate behavioural tendencies by somewhat different means. However, considering that the underlying mechanisms are proposed to be similar, there may be a comparable relationship between exposure and outcome behaviour for the mimicry effect. Therefore, mimicry may also be moderated by perceptual characteristics of the target gestures.

The suggestion from the previous chapter that exposure to a high frequency of target gestures may decrease or inhibit mimicry behaviour would likely present similar issues if the frequency of the target gesture was manipulated to explore the effect of exposure. Instead, manipulating the duration that participants were exposed to the target gesture (e.g., Dijksterhuis & van Knippenberg, 1998) was employed to examine the way in which differences in target gesture presentation influences mimicry behaviour. Notably, manipulating the duration of exposure to target gesture permitted the frequency per minute face-rubbing was presented to be reduced, compared to the frequency that was presented in Experiments 1a and 1b.

In view of the issues with gesture presentation in the previous chapter, investigating the role exposure to target gestures would provide valuable information with regard to developing a reliable mimicry paradigm. In addition to reducing the frequency of target gesture presentation, the methodological changes discussed above were implemented to refine the mimicry paradigm. Firstly, a between-participants design to present the target gesture and no gestures to demonstrate nonconscious mimicry was employed, which included a one minute pre-experiment measure of baseline behaviour for all participants. Secondly, an adapted form of the photo-description task, most commonly used in the mimicry literature, was used as the new experiment task in which mimicry behaviour was measured. Lastly, manipulation checks were also included to ensure potential factors such as the way that the actor was perceived and the affective state of the participants were not influencing potential behavioural changes. As a result of these refinements, Experiment 2 was expected to demonstrate mimicry behaviour relative to a control condition, and to show that increased exposure to the target gestures would result in greater instances of

mimicry behaviour. Once a suitable paradigm can be identified to demonstrate the mimicry effect, the aim of investigating the generalisability of nonconscious mimicry from Experiment 1a can be pursued. This aim will be discussed further once the mimicry effect has been demonstrated.

3.2 Experiment 2

3.2.1 Overview

Experiment 2 aimed to demonstrate the nonconscious mimicry of face-rubbing behaviour relative to an experimentally similar control condition. In addition, this experiment investigated the effect of duration of exposure to target gestures on mimicry behaviour. It was predicted that participants who saw face-rubbing in the stimulus video would express a significantly higher rate of face-rubbing than participants who saw no gestures, thus demonstrating nonconscious mimicry. In line with the previous findings in the automatic trait and stereotype priming literature (Dijksterhuis & van Knippenberg, 1998), it was predicted that participants who were exposed to the face-rubbing stimulus video twice (e.g., exposed to the target gesture for 7 minutes) would express a greater rate of face-rubbing behaviour compared to those who were exposed to the same video stimulus once (e.g., exposed to the target gestures for 3.5 minutes). Those in the no gesture condition were not expected to be influenced by the manipulation of video exposure.

3.2.1.1 Development of the Stimulus Videos

A recently graduated female student unknown to participants was video-recorded, visible from the mid-torso up, describing two photographs of nature scenes. The first photograph depicted a snow covered village and the second showed an undersea diver. The actor was video-recorded while describing the visual aspects of each photograph from a prepared script (see Appendix 4), which included pauses and ‘ums’ to increase the believability of the cover story that the actor was a previously recorded participant. The actor was video-recorded describing the photographs, once while performing face-rubbing (approximately 16 touches per minute) and once while performing no gestures (see Figure 3.1). Notably, the actor’s performance of face-rubbing was approximately three times less than the performance of the face-rubbing gesture in the previously employed stimulus video. Both versions of the recorded videos were edited to 3.5 minutes in length and contained the

same verbal description of the photographs. As in the previous chapter, face-rubbing by the actor was performed within the oval of the face from the jaw-line to the forehead.



Figure 3.1. Example video stills of face-rubbing and no gestures recorded in the stimulus videos.

3.2.2 Method

3.2.2.1 Participants and Design

Ninety-one undergraduate psychology students (73 females, 18 males; age $M = 19.72$, $SD = 3.51$) were randomly allocated to a 2 (gesture in video: no gesture vs. face-rubbing) x 2 (exposure: 1 video exposure vs. 2 video exposures) between-participants design.

Participants received partial course credit as payment for participation.

3.2.2.2 Procedure

Before participants entered the laboratory a video camera was placed above the computer monitor and was turned on to record the participant's behaviour throughout the experiment. All participants were tested individually, and given the following cover story:

“This study is examining potential differences in face-to-face communication versus communication via video. Specifically, we are interested in how easily

people interpret information presented in each format. You have been assigned to the video based condition which means that you will be watching and giving feedback on a video clip of a previously recorded participant describing two different photos to you. You will then be asked to perform the same task with a new set of two photos which will be recorded and rated by another participant in a later session.”

This cover story provided a somewhat more interactive task than the previously employed memory recall task, and gave a plausible reason to video record the participants.

After receiving instructions, participants completed the pre-experiment Self-Assessment Manikin (SAM) measure. Then the experimenter left the room for one minute (telling participants a form that was needed later in the experiment had been left in another room) which provided a baseline reading of the participant’s behaviour prior to the photo-description task. Upon returning the experimenter instructed all participants to attend carefully to the video, as they would be asked to answer a few questions about the video. In addition, participants in the two exposures condition were told that they would be shown this video twice to make sure they fully comprehended the details of the description.

After starting the stimulus video, the experimenter sat out of view of the participant. Participants assigned to the one video exposure condition were shown the stimulus video once, while those assigned to the two video exposures condition were shown the same stimulus video twice. This allowed for the participants allocated to the face-rubbing gesture condition to see the same frequency per minute of face-rubbing behaviour while manipulating the duration of exposure to the actor’s behaviour. Once the video finished, participants were asked to complete a questionnaire about how they perceived the actor, before describing their own set of two new photographs. The two photographs shown to the participants were of a similar nature to the photographs the actor described. Specifically, all participants saw two photographs, one of an interior of a cave which had paintings on the wall and one of a coastal village. Participants were given two minutes with each of the photographs to describe or say “anything that came to mind about them”. The photographs were presented one at a time on a computer screen, consisting of a three second blank screen followed by a full screen display of the first photograph. After two minutes a blank screen again appeared for three seconds followed by the second

photograph displayed for two minutes. Once participants finished their descriptions they completed the dependent measures described below before being debriefed and thanked for their participation.

3.2.2.3 Dependent Measures

Affect Measure

The Self-Assessment Manikin, SAM (Lang, 1985) questionnaire was used to measure emotional response both pre- and post- photo-description task (see Appendix 5). This acted as a manipulation check of possible affect change across the experiment session, and between the gesture and exposure conditions. The SAM measure evaluated the valence and arousal dimensions of the participant's emotional state. This included a pictorial scale for valence anchored 1 happy to 5 unhappy. The second pictorial scale for arousal anchored 1 relaxed to 5 stimulated. The valence scale has been validated to indicate the degree of happiness to unhappiness experienced by an individual, whereas the arousal scale have been established to indicate the degree to which an individual's emotional state is calm to anxious or nervous (Lang et al., 1997; Mehrabian & Ljunggren, 1997).

Perception of the Actor

Participants were asked to rate how much they liked the actor and how the actor's mood was perceived on a seven point scale (see Appendix 6) directly after watching the stimulus video. This questionnaire was used as a manipulation check for the overall ratings of liking and the perceived mood of the actor, and that these rating did not differ depending on gesture seen or amount of exposure to the actor.

Awareness Check

Finally, the same funnelled debrief questionnaire as used in Experiment 1b was employed to determine participants' awareness of the actor's behaviour and their suspicions as to the true aim of the experiment.

Participant Behaviour

The video-recorded experiment sessions were used for later coding of participants' face-rubbing behaviour. The same coding scheme and practice as previously used in Experiment 1a and 1b was employed to determine the frequency with which participants expressed face-rubbing behaviour. As in Experiments 1a and 1b a rate per minute score of participant face-rubbing behaviour was calculated. This yielded a rate per minute score for both the 1 minute baseline period, and a rate per minute score for participant behaviour while watching the stimulus video and describing two photographs (7.5 minutes in the one exposure condition, and 11 minutes in the two exposures condition). A rate per minute measure was required as the baseline, one exposure condition and two exposures conditions were all of different lengths.

3.2.3 Results and Discussion

Awareness Check

One participant was excluded from analysis for paying insufficient attention to the video during the experiment.⁴ The responses of the remaining 90 participants to the awareness check were analysed to confirm that any mimicry behaviour observed occurred without participant awareness of the effect. Participants responses to the questions in the funnelled debrief were collapsed, and showed 4.4 % (4 out of 90; all of whom were in the two video exposures condition) of participants explicitly stated that the gesture 'face-rubbing' was unusual. However, of those four participants none were able to guess the main aim of the study and were included in the behavioural mimicry analyses.⁵

3.2.3.1 Behavioural Mimicry

To check the reliability of behaviour coded as face-rubbing, 30% of participant video-recorded sessions were double-coded by a second coder blind to condition and the

⁴The participant was identified during video coding as looking away from the computer monitor for over half of the video stimulus presentation.

⁵ Notably, the behavioural analysis shows a similar pattern of results when these four participants were removed.

hypotheses of the experiment. The inter-rater reliability for participants' face-rubbing behaviour was high, $r = .92$, $p < .001$, Cronbach's $\alpha = 0.96$.

Exploratory analysis of the behavioural data revealed violations of normal distribution; as a result, five participants were removed as outliers on the basis that they were 2.5 standard deviations above the mean rate of face-rubbing behaviour (Upton & Cook, 2008; van Baaren et al., 2006). This corrected distribution violations. To reiterate, the data for six participants were excluded (one for paying insufficient attention and five as statistical outliers), leaving 85 participants balanced across gesture and exposure conditions in all subsequent analyses.

A 2 (gesture in video: no gesture vs. face-rubbing) x 2 (video exposure: 1 video exposure vs. 2 video exposures) between-participants ANOVA was conducted on the frequency of face-rubbing per minute expressed. Analysis revealed a significant main effect of gesture in video, $F(1, 81) = 5.47$, $p = .02$, $f^2 = 0.27$. As predicted those who saw face-rubbing in the gesture video expressed face-rubbing ($M = 0.92$, $SD = 0.90$) at a higher rate than those who saw no gestures ($M = 0.51$, $SD = 0.67$). The analysis revealed no significant main effect of video exposure, $F < 1$, $p = .76$, $f^2 = 0.03$, and no significant interaction between gesture in video and video exposure, $F < 1$, $p = .33$, $f^2 = 0.10$. Contrary to predictions, the interaction between gesture and exposure was not significant. However, an exploratory examination of the means (see Figure 3.2) suggests that nonconscious mimicry of face-rubbing behaviour occurred to a slightly greater degree, relative to the control condition, in the two video exposures condition.

The pre-experiment baseline measure of participant face-rubbing behaviour was initially considered as a covariate factor within the mimicry analysis. However, examination of this measure showed that face-rubbing behaviour was exceedingly high for both those in the no gesture ($M = 2.80$, $SD = 3.40$) and face-rubbing gesture conditions ($M = 3.22$, $SD = 3.89$), consistently across the one exposure ($M = 2.76$, $SD = 3.49$) and two exposure ($M = 3.28$, $SD = 3.82$) manipulation. Overall, baseline behaviour was nearly triple the rate of face-rubbing expressed in the experiment period.

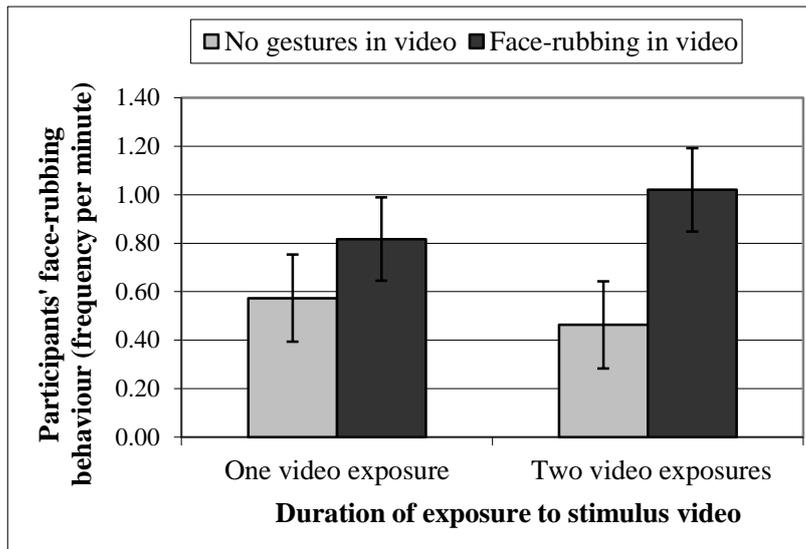


Figure 3.2. Mean face-rubbing behaviour as a function of gesture video and amount of exposure +/- 1 SEM.

Furthermore, the pre-experiment baseline measure of participant face-rubbing behaviour did not meet the assumptions of the ANCOVA model as a covariate. As the ANCOVA adjusts the mean face-rubbing behaviour expressed during the experiment based on linear regression, the relationship between the covariate baseline behaviour and the experiment behaviour must be a linear one (Garson, 2009), or would be expected to be significantly correlated (Raab, Day & Sales, 2000). However, the face-rubbing behaviour expressed in the baseline measure and in the experiment period did not show a significant linear relationship, $r = 0.10$, $p = .39$. Thus, the baseline measure was not included in the mimicry analysis as a covariate. The potential causes of this finding will be returned to in the discussion section.

3.2.3.2 Secondary Measures

SAM Measure

A 2 (time: pre-SAM vs. post-SAM) x 2 (gesture in video: no gestures vs. face-rubbing) x 2 (video exposure: 1 exposure vs. 2 exposures) mixed ANOVA was conducted with time as the within-participant factor. This analysis was conducted on each SAM item separately. Ratings on the SAM pleasure scale (see Table 3.1) showed no main effect of gesture in video, $F(1, 81) = 1.25$, $p = .27$, $f^2 = 0.12$, no main effect of video exposure, $F(1, 81) = 1.17$, $p = .28$, $f^2 = 0.12$, and all interactions were not significant, $F < 1$, ns , $f^2 = 0.30$. However, there was a significant main effect of time, $F(1, 81) = 10.29$, $p = .002$, $f^2 = 0.32$.

Participants reported a decrease in happiness at the end of the photo-description task ($M = 2.32$, $SD = 0.68$), compared to ratings at the start of the experiment ($M = 2.09$, $SD = 0.63$). However, ratings at both time points were significantly below the midpoint (3) of the scale, pre-experiment $p < .001$, $d = 1.3$, and post-experiment $p = .01$, $d = 1.0$. These results suggested that participants were still relatively happy throughout the study.

Ratings on the SAM arousal scale (see Table 3.1) showed no significant main effect of gesture in video, $F < 1$, $p = .60$, $f^2 = 0.10$, and no main effect of video exposure, $F < 1$, $p = .59$, $f^2 = 0.10$. There was, however, a significant main effect of time, $F(1, 81) = 4.17$, $p = .04$, $f^2 = 0.20$. Participants experienced an increase in feelings of nervousness after the photo-description task ($M = 2.74$, $SD = 0.86$), relative to ratings at the start of the experiment ($M = 2.56$, $SD = 0.76$). Analysis also showed a significant interaction between time and exposure, $F(1, 81) = 5.19$, $p = .03$, $f^2 = 0.30$, and all other interactions were not significant, $F < 1$, ns , $f^2 = 0.10$.

Decomposing the interaction between time and exposure revealed the increase in nervousness appeared to be driven by those exposed to the stimulus video twice. Participants in the two exposures condition experienced an increase in feelings of nervousness between the pre ($M = 2.51$, $SD = 0.80$) and post ($M = 2.88$, $SD = 0.91$) measures, $t(42) = -2.71$, $p = .01$, $d = 0.48$. Those in the one exposure condition showed no change in feelings of nervousness between pre ($M = 2.62$, $SD = 0.73$) and post ($M = 2.60$, $SD = 0.80$) measures, $t(41) = 0.24$, $p = .81$, $d = 0.10$. Nonetheless, in the two video exposures condition both time points were significantly below the midpoint (3) of the scale, pre-experiment, $p < .001$, $d = 0.55$, and post-experiment, $p = .01$, $d = 0.27$. This suggests participants were still relatively calm throughout the study.

Table 3.1

Mean Ratings on the SAM Pleasure and Arousal Scales as a Function of Time, Gesture in Video and Duration of Exposure

	No gestures in video		Face-rubbing in video	
	1 Exposure	2 Exposures	1 Exposure	2 Exposures
<i>SAM Pleasure</i>				
Pre-measure	2.00 (0.56)	2.10 (0.63)	2.27 (0.63)	2.00 (0.69)
Post-measure	2.40 (0.88)	2.05 (0.59)	2.41 (0.50)	2.41 (0.67)
<i>SAM Arousal</i>				
Pre-measure	2.65 (0.88)	2.38 (0.87)	2.59 (0.59)	2.64 (0.73)
Post-measure	2.70 (0.87)	2.71 (0.96)	2.50 (0.74)	3.05 (0.84)

Perception of the Actor

A 2 (gesture in video: no gestures vs. face-rubbing) x 2 (video exposure: 1 exposure vs. 2 exposures) between-participants ANOVA was computed on liking of the actor and the mood of the actor separately. Ratings of how the actor was liked showed no significant main effect of gesture in video, $F < 1$, $p = .65$, $f^2 = 0.17$, no main effect of amount of exposure, $F(1, 81) = 2.27$, $p = .14$, $f^2 = 0.15$, and no significant interaction $F < 1$, $p = .63$, $f^2 = 0.06$. Additionally, ratings of how much participants liked the actor ($M = 4.98$, $SD = 1.02$) was significantly greater than the midpoint (4) of the scale, $t(84) = 8.80$, $p < .001$, $d = 1.18$. This indicated that participants rated the actor as relatively likable.

Ratings of the perceived mood of the actor showed no significant main effect of gesture in video, $F(1, 81) = 2.61$, $p = .11$, $f^2 = 0.05$, no main effect of amount of exposure, $F(1, 81) = 1.86$, $p = .18$, $f^2 = 0.16$, and no significant interaction, $F < 1$, $p = .55$, $f^2 = 0.05$.

Additionally, ratings on the perceived mood of the actor ($M = 5.02$, $SD = 0.83$) were significantly greater than the midpoint (4) of the scale, $t(84) = 11.36$, $p < .001$, $d = 1.23$. Thus, participants perceived the actor to be in a positive mood. Together with the rating of liking of the actor, these findings suggest that this positive perception was not influenced by the behaviour of the actor or the amount of exposure to the actor.

3.2.3.3 Discussion

Experiment 2 demonstrated nonconscious mimicry relative to a control condition, with participants expressing significantly more face-rubbing following exposure to face-rubbing gestures than following exposure to no gestures. The results also indicate that the duration of exposure to target gestures did not significantly influence the magnitude of mimicry observed. In line with the predictions made, participants displayed higher, albeit not significantly higher, levels of mimicry behaviour when exposed to the actor performing face-rubbing for seven minutes (e.g., two video exposures condition) compared to three and a half minutes (e.g., one video exposure condition). One possible reason for this non-significant influence of exposure may have been the relatively small effect size ($f^2 = 0.10$) of the exposure duration factor. Post hoc power analysis indicated that there was a 15% chance of detecting an effect of duration of exposure given the sample size collected ($N = 85$). This sample size is consistent with, if not larger than, those generally used in the mimicry literature employing a similar 2 x 2 between-participants design (e.g., $N = 20-53$, Cheng & Chartrand, 2003; Lakin & Chartrand, 2003; Karremans & Verwijmeren, 2008). However, to achieve a 50% chance of detecting the effect a sample of 350 participants would have been needed. Given the practicalities of testing and time constraints within the present thesis, this was not possible.

Nevertheless, the finding that the duration of exposure did not act as an influential perceptual factor in automatic mimicry behaviour is in contrast with previous findings in automatic trait and stereotype priming (Dijksterhuis & van Knippenberg, 1998). Experiment 2 provides initial evidence for the possibility that the perceptual characteristics of target primes may influence the perception-behaviour link differently for automatic behaviour priming and automatic trait and stereotype priming. This possibility will be discussed in more depth at the end of the chapter.

The pre-experiment one minute baseline measure introduced did not appear to adequately measure baseline rates of face-rubbing behaviour, as participant behaviour was nearly triple the rate of face-rubbing behaviour expressed during the photo description task consistently across gesture and exposure conditions. This baseline measure was employed as an additional control variable to account for variance from natural face-rubbing behaviour. Thus, it was expected to be approximately similar to the face-rubbing behaviour

expressed in the no gesture condition. The fact that overall baseline behaviour was so high suggested that the baseline measure would not help to explain additional variance in participant behaviour between the gesture and no gesture conditions.

One possible explanation for the high rate of face-rubbing expressed in the baseline measure was the experimental context in which it was taken. Specifically, participants had just arrived to the testing room and, after being informed that they would be video recorded for this experiment, were left alone in the room for one minute. The relatively short period of time that was used to measure baseline behaviour may have included additional fidgeting behaviour associated with nervousness from the recent knowledge of being video recorded (see SAM measure discussion below), which was further compounded by not being engaged in any type of task but simply waiting for the experimenter to return. However, because the one minute pre-experiment baseline appears to be relatively successful in the previous mimicry literature (e.g., Cheng & Chartrand, 2003; Lakin et al., 2008; van Baaren, Holland, Steenaert, & van Knippenberg, 2003a) further testing is required before changes to this measure are considered.

Ratings on the SAM measure suggested that participants rated themselves as feeling relatively happy and calm across the experiment. Although findings suggested that participants experienced an increase in feelings of anxiety and a decrease in feelings of happiness at the end of the photo-description task, it is likely that this was due to the nature of this paradigm. Participants knew that they were being video-recorded, which has been shown to increase anxiety levels (George & Stopa, 2008). This explanation is further supported by the finding that participants in the two video exposures condition, who spent a longer period of time in front of the video camera, reported greater levels of anxiety as compared to those in the one video exposure condition. This increase in anxiety may also account for the decrease in ratings of happiness reported by participants, as increased levels of anxiety have been shown to be accompanied by low levels of positive affect (Hughes et al., 2006).

Importantly, this change of emotional state over time was consistent for those who saw the actor perform no gestures and for participants who saw face-rubbing performed. A similar consistency across gesture and exposure conditions was found in the positive ratings of how participants perceived the actor in the stimulus video. These findings suggest that the

factors previously demonstrated to moderate mimicry behaviour, particularly emotional state (van Baaren et al., 2006; Vrijesen et al. , 2010) and liking (Lakin & Chartrand, 2003; Lakin, 2006; Chartrand & Dalton, 2009), were not likely to be driving the difference in face-rubbing behaviour found between the two gesture conditions during the photo-description task.

Evidence from the funnelled debrief showed a noticeable improvement in participants' non-awareness of the target gesture. Particularly, the face-rubbing behaviour of the actor was only explicitly cited as unusual by 4.4% of participants. In contrast, Experiments 1a and 1b found 66.6% and 47.1% of participants, respectively, were able to explicitly report the actor's performance of the target gesture as unusual. The level of awareness found in Experiment 2 is generally held to be acceptable within the mimicry literature, as it is not unusual for around 5% of participants to cite some level of awareness of the target prime (Bargh & Chartrand, 2000). Overall, the results from Experiment 2 suggest that the refinement of the mimicry paradigm was successful in demonstrating nonconscious mimicry. Thus, the remainder of this chapter focuses on investigating the generalisability of the mimicry effect.

Generalisability of Nonconscious Mimicry

Nonconscious mimicry has been consistently demonstrated with a small number of gestures, primarily face-rubbing and foot-shaking (e.g., Cheng & Chartrand, 2003; Vrijesen et al., 2010; van Baaren et al., 2004a). However, there should be nothing exceptional in the perceptual characteristics of these gestures that means that mimicry can only occur when employing these particular gestures. Under the hypothesised perception-behaviour link mechanism underlying nonconscious mimicry, the mere perception of an individual's behaviour should automatically increase the probability of the perceiver engaging in that behaviour (Chartrand & Bargh, 1999). Therefore, perception of any common behaviour, not just face-rubbing and foot-shaking, would be expected to increase the probability of mimicking that behaviour. Indeed, research on automatic imitation, which is proposed to share a similar underlying mechanism to that of nonconscious mimicry (Chartrand & Dalton 2009; Gillmeister, Catmur, Liepelt, Brass, & Heyes, 2008), has been shown to reliably occur on a variety of actions using different areas of the body (Wheaton, Thompson, Syngeniotis, Abbott, & Puce, 2004). Considering the evidence from research

on automatic imitation, mimicry behaviour would also be expected to generalise to a number of other common gestures.

However, Experiment 1a found that mimicry behaviour did not occur, which could suggest the effect does not extend to new gestures, such as hair-touching and knee-bouncing. This might be explained by participants being acutely aware of the target gestures, but equally it may be that the effect does not generalise across a range of behaviours. Having identified a paradigm that can demonstrate mimicry relative to a control condition, Experiment 3 revisits the aim to examine the generalisability of nonconscious mimicry. In addition, Experiment 3 endeavours to extend this by exploring the subtlety of the target gestures presented. Specifically, to examine whether mimicry of more localised gestures (e.g., nose-rubbing and cheek-rubbing), as compared to more global mimicry expression (e.g. more general face-rubbing behaviour), will occur when participants are presented with these types of localised target gestures. The use of localised gestures is a departure from the more general gestures manipulated in the mimicry literature to date. However, research in imitation behaviour has demonstrated that individuals are able to reliably differentiate fine motor actions, such as subtle finger lifting and tapping movements (Brass, Bekkering, & Prinz, 2001), subtle finger sliding movements (Catmur & Heyes, 2010) and index and middle finger movements (Berthenhal, Longo, & Kosbud, 2006), to show automatic imitation effects. Thus, Experiment 3 aims to investigate the possibility that the mimicry effect may also reliably differentiate between subtle actions, by exploring whether nonconscious mimicry generalises to gestures that are localised in nature.

3.3 Experiment 3

3.3.1 Overview

The primary aim of Experiment 3 was to demonstrate the generalisability of the mimicry effect. To examine this, the same mimicry paradigm that successfully demonstrated nonconscious mimicry in Experiment 2 was employed. However, participants were exposed to no gestures, or to one of two new gestures identified in a behaviour recoding exercise (discussed below), namely, either cheek-rubbing or ear-touching.

In line with a direct perception-to-behaviour link mechanism that is proposed to underlie mimicry (Chartrand & Bargh, 1999), the mere perception of cheek-rubbing and ear-

touching was predicted to automatically increase the probability of engaging in these behaviours. Therefore, it was predicted that participants would express the new gestures at a higher rate when exposed to the target gestures, compared to target behaviour expressed in the no gesture condition. Furthermore, it was predicted that participants expression of the target gestures would be localised to the area to which they observed the actor expressing the target gestures. In other words, participants were expected to express mimicry of the localised gestures only, not more general face-rubbing behaviour.

3.3.1.1 Identifying New Target Gestures

As the results in Experiment 2 indicated that mimicry could be obtained for face-rubbing behaviour, and that facial stimuli are suggested to both capture and retain visual attention to a greater degree than non-face stimuli (Bindemann, Burton, Hooge, Jenkins, & de Haan, 2005); new localised gestures around the face were considered. To simplify this process only gestures in the face area that were generated in the previous pilot questionnaire (adapted from Mehrabian and Friedman, 1986) were used (see Appendix 1 for full list). From this, cheek-rubbing and ear-touching emerged as optimal gestures as they were independent of each other, shared approximately similar surface areas and were discernibly different enough to be coded as two separate gestures. However, to avoid the possibility that either of these gestures are typically expressed at floor levels and thus may not be suitable for analysis, such as with the knee-bouncing gestures employed in Experiment 1a, actual participant behaviour was analysed.

This involved recoding the video-recorded sessions from Experiment 1 of the participants who saw no gestures in the stimulus video ($N = 23$). Since these participants were exposed to no gestures, it was expected that they would express natural non-verbal behaviour. Results from the recoding of Experiment 1 control participant video indicated that participants expressed cheek-rubbing, ($M = 0.34$, $SD = 0.64$ rate per minute) and ear-touching, ($M = 0.05$, $SD = 0.13$ rate per minute) significantly above floor levels (0), $t(22) = 3.23$, $p = .004$ $d = 0.67$ and $t(22) = 2.08$, $p < .05$, $d = 0.43$, respectively. Therefore, cheek-rubbing and ear-touching were selected as the two new target gesture for the separate gesture conditions.

3.3.1.2 Development of the Stimulus Videos

The videos were identical to Experiment 2, using the same actor and script; however, the actor performed the two new gestures identified in the recoding of Experiment 1 control participant behaviour. Since the lower rate of gestures performed by the actor resulted in demonstrating mimicry and relatively few reports of awareness in Experiment 2, the actor was video-recorded performing the two new gestures at an approximately similar rate. The actor was recorded describing the photographs, once while performing cheek-rubbing (approximately 14 touches per minute), and once while performing ear-touching (approximately 12 touches per minute)⁶ (see Figure 3.3). Cheek-rubbing was only displayed by the actor at the front of the face, from cheek bone to jaw line and ear-touching included any part of the ear. The same no gesture stimulus video from the previous experiment was used, with all three video versions edited to 3.5 minutes in length.



Figure 3.3. Example video stills of cheek-rubbing and ear-touching recorded in the stimulus videos.

⁶ The small difference in the gesture rate was not expected to significantly influence participants' mimicry behaviour. Although Experiment 2 found that mimicry appeared to be more robust with greater gesture exposure, increased exposure did not result in a significant change in participant behaviour.

3.3.2 Method

3.3.2.1 Participants and Design

Ninety-two undergraduate psychology students (78 females, 14 males; age $M = 20.69$, $SD = 4.23$) were randomly allocated to a 3 (gesture in video: no gesture vs. cheek-rubbing vs. ear-touching) factor between-participants design. Participants received partial course credit as payment for participation.

3.3.2.2 Procedure

The same procedure as was used in Experiment 2 was employed with the following exceptions. Due to the increased, albeit not significantly so, instances of mimicry behaviour in the two exposures condition in Experiment 2 all participants were shown the stimulus videos twice, with each version lasting seven minutes. This allowed for a longer period to measure participant behaviour and doubled the amount of gestures that participants in the cheek-rubbing and ear-touching conditions were exposed to. All participants were told, as in Experiment 2, that they would be shown this video twice to make sure they fully comprehended the details of the description.

3.3.2.3 Dependent Measures

Measures of affect, perception of the actor and an awareness check were taken, all of which were identical to those used in Experiment 2. Participants' expression of the target gestures was only coded as such if they were within a similar area to the way that the actor performed these gestures. So, for example, instances of cheek-rubbing were only coded if expressed at the front of the face, from cheek bone to jaw line. Coding of ear-touching included a touch to any part of the ear. Each participant was blind-coded for the frequency of cheek-rubbing, ear-touching and overall face-rubbing (as coded in Experiment 2) behaviour expressed. The same frequency per minute score used in Experiment 2 was taken for each of the target gestures per participant.

3.3.3 Results and Discussion

Awareness Check

Mimicry behaviour data was treated the same way as in Experiment 2. The response of participants to the awareness check showed that 25% (23 out of 92) of participants explicitly stated that the gesture ‘face-rubbing/cheek-rubbing’ ($N = 10$) or ‘ear-touching’ ($N = 13$) was unusual. Within these 23 participants who explicitly reported the target gestures, six participants reported that they believed that the study was examining mimicry behaviour, and were removed from all further analyses. Notably, both the number of participants that explicitly reported the target gestures and those that were able to guess the main aim of the study were higher than expected. This will be further discussed at the end of the chapter.

3.3.3.1 Behavioural Mimicry

The cheek-rubbing and ear-touching gestures expressed by participants were analysed separately for mimicry effects. To check the reliability of behaviour coded as cheek-rubbing, ear-touching and face-rubbing, 30% of participants’ video-recorded sessions were double coded by a second coder blind to condition and the hypotheses of the experiment. The inter-rater reliability for participants’ cheek-rubbing, $r = .75$, $p < .001$, $\alpha = 0.86$, ear-touching, $r = .56$, $p = .01$, $\alpha = 0.71$, and face-rubbing behaviour $r = .68$, $p = .001$, $\alpha = 0.81$, was acceptable. Exploratory analysis revealed participants’ cheek-rubbing and ear-touching behaviour showed non-normal distributions. Thus, two participants were removed as outliers 2.5 standard deviations above the mean rate of the cheek-rubbing expressed, and one participant was removed as an outlier 2.5 standard deviations above the mean rate of the ear-touching expressed (Upton & Cook, 2008; van Baaren et al., 2006). However, removing outliers and Log10 transforming did not correct data distribution. Thus, the rate per minute cheek-rubbing and ear-touching behavioural data was used with outliers removed, and the subsequent analyses reported used the adjusted t -statistics for non-normal distribution. To reiterate, a total of nine participants were removed from all further analyses (six for guessing the main aim of the study and three as statistical outliers), leaving 83 participants in the final analyses.

Cheek-Rubbing Behaviour

A 2 (gesture in video: no gesture vs. cheek-rubbing) factor between-participants t-test was conducted on the frequency of cheek-rubbing per minute expressed. As predicted, there was a significant effect of gesture in video, $t(31.58) = -1.75, p < .05$ (one-tailed), $d = 0.50$. The results suggest that participants expressed significantly higher levels of cheek-rubbing behaviour when watching the actor perform cheek-rubbing compared to those who saw the actor performing no gestures (see Figure 3.4).

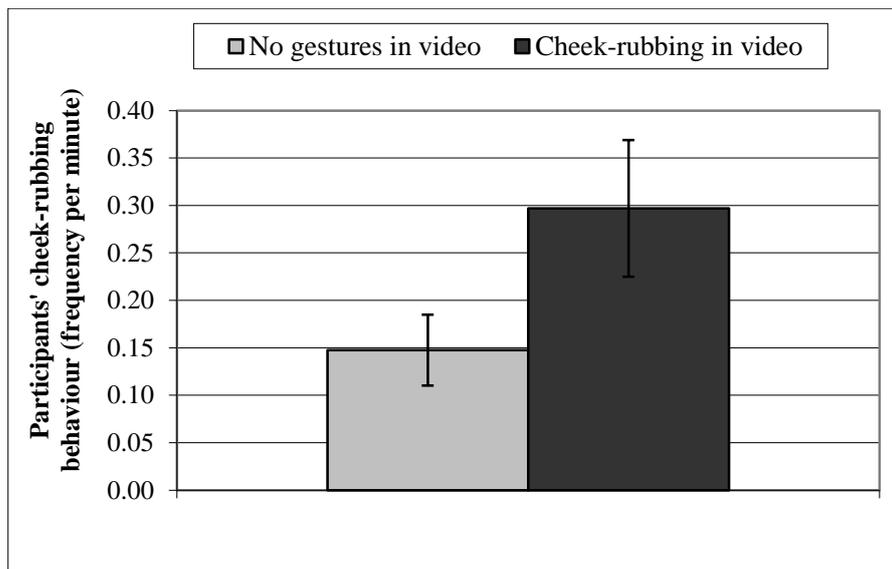


Figure 3.4. Mean participant cheek-rubbing behaviour as a function of gesture video +/- 1 SEM.

Ear-Touching Behaviour

A 2 (gesture in video: no gesture vs. ear-touching) factor between-participants t-test was conducted on the frequency of ear-touching per minute expressed. Analysis revealed a significant effect of gesture in video, $t(47.57) = -1.76, p = .04$ (one-tailed), $d = 0.40$. Participants expressed a significantly higher rate of ear-touching behaviour when shown the actor performing ear-touching in the stimulus video compared to those who saw no gestures performed (see Figure 3.5).

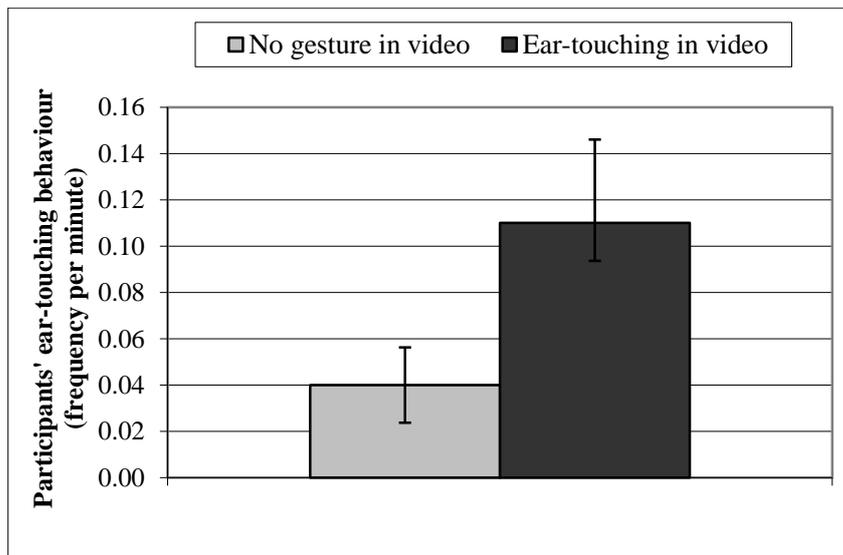


Figure 3.5. Mean participant ear-touching behaviour as a function of gesture in video +/- 1 SEM.

The pre-experiment baseline measure of participant cheek-rubbing and ear-touching behaviour was initially considered as a covariate factor within the mimicry analysis. However, examination of this measure showed cheek-rubbing was substantially high, relative to behaviour expressed in the photo-description task, both in the no gesture ($M = 1.22$, $SD = 1.78$) and gesture present ($M = 0.68$, $SD = 1.21$) conditions. Similarly, ear-touching at baseline was high in the control condition ($M = 0.32$, $SD = 0.61$), though was relatively similar to experiment period levels in the gesture present condition ($M = 0.15$, $SD = 0.50$). Furthermore, the pre-experiment baseline measure of participant behaviour did not meet the linear relationship assumption of the ANCOVA model as a covariate (Garson, 2009). Namely, cheek-rubbing behaviour expressed in the baseline measure and in the experiment period did not show a significant linear relationship, $r = 0.02$, $p = .84$. Likewise, ear-touching baseline and experiment behaviour was did not show a significant linear relationship, $r = 0.21$, $p = .08$. Thus, the one-minute baseline measure was not included in the mimicry analysis as a covariate. Since it was planned to analyse the two target gestures separately the mimicry analysis was simplified to independent t-test comparisons.⁷

⁷ Since no predictions were made about the cheek-rubbing expressed when exposed to the actor performing ear-touching, or, vice versa ear-touching expressed when exposed to cheek-rubbing, a MANOVA was considered inappropriate for the mimicry analysis.

Generalisability of Mimicry

Because cheek-rubbing and ear-touching can be considered a localised component of the more typically manipulated general face-rubbing gesture, it was possible that perception of the two target gesture simply elicited generalised face-rubbing behaviour. To examine this possibility, and as a more stringent test that nonconscious mimicry extended to the cheek-rubbing and ear-touching gestures specifically, the general face-rubbing behaviour of the participants in the above mimicry analysis was examined.

A 3 (gesture in video: no gesture vs. cheek-rubbing vs. ear-touching) between-participants ANOVA⁸ was conducted on participants' frequency per minute general face-rubbing behaviour expressed. Analysis showed no significant main effect of gesture in video, $F < 1$, $p = .42$, $f^2 = 0.15$. Participants showed no difference in general face-rubbing when shown the actor performing the more localised cheek-rubbing gesture ($M = 1.06$, $SD = 1.13$) or ear-touching gesture ($M = 0.68$, $SD = 0.85$), compared to seeing the actor perform no gestures ($M = 0.95$, $SD = 1.31$). These results suggest that when participants observed the actor performing cheek-rubbing or ear-touching in the stimulus video, mimicry of the localised gestures occurred, and this effect was not merely an artefact of more general face-rubbing mimicry.

3.3.3.2 Secondary Measures

SAM Measure

A 2 (time: pre-SAM vs. post-SAM) x 3 (gesture in video: no gesture vs. cheek-rubbing vs. ear-touching) mixed ANOVA was conducted with time as the within-participant factor. This analysis was conducted on each SAM item separately. Ratings on the SAM pleasure scale (see Table 3.2) showed no significant main effect of time, $F(1, 80) = 1.83$, $p = .18$, $f^2 = 0.18$, no main effect of gesture in video, $F < 1$, $p = .89$, $f^2 = 0.03$, and no significant interaction between time and gesture seen, $F < 1$, $p = .39$, $f^2 = 0.21$. Results also showed that overall participants rated themselves significantly below the midpoint (3) of the scale at pre- experiment, ($M = 2.07$, $SD = 0.70$), $t(82) = 12.17$, $p < .001$, $d = 1.18$, and post-

⁸ An ANOVA was conducted because only one behaviour measure (e.g., face-rubbing) was examined, as opposed to the two different behaviour measures (e.g., cheek-rubbing and ear-touching) examined in the main mimicry analyses.

experiment measures ($M = 2.17$, $SD = 0.76$), $t(82) = 9.94$, $p < .001$, $d = 0.98$, suggesting that participants were relatively happy across the study.

Ratings on the SAM arousal scale (see Table 3.2) showed no significant main effect of gesture in video, $F < 1$, $p = .76$, $f^2 = 0.02$, and no significant interaction between time and gesture, $F < 1$, $p = .71$, $f^2 = 0.05$. However, there was a significant main effect of time, $F(1, 80) = 5.46$, $p = .02$, $f^2 = 0.32$. Participants experienced an increase in feelings of nervousness after the photo-description task ($M = 2.90$, $SD = 0.92$), relative to ratings at the start of the experiment ($M = 2.67$, $SD = 0.77$). Ratings on the pre-experiment measure were significantly below the midpoint (3) of the scale, $t(82) = 3.87$, $p < .001$, $d = 0.51$. However, ratings on the post-experiment were not significantly different to the midpoint of the scale, $t(82) = 0.96$, $p = .34$, $d = 0.15$. Nevertheless, this increase in arousal did not indicate that participants were exceedingly anxious.

Table 3.2

Mean Ratings on the SAM Pleasure and Arousal Scales as a Function of Time and Gesture Condition

	No gestures in video	Cheek-rubbing in video	Ear-touching in video
<i>SAM Pleasure</i>			
Pre-measure	2.03 (0.63)	2.09 (0.61)	2.09 (0.82)
Post-measure	2.24 (0.83)	2.23 (0.69)	2.06 (0.76)
<i>SAM Arousal</i>			
Pre-measure	2.66 (0.90)	2.73 (0.70)	2.66 (0.70)
Post-measure	2.97 (1.02)	3.00 (0.93)	2.78 (0.83)

Perception of Actor

A 3 (gesture in video: no gesture vs. cheek-rubbing vs. ear-touching) factor between-participants ANOVA was conducted on liking of the actor and the mood of the actor separately. Ratings of how much the actor was liked showed no significant main effect of gesture in video, $F < 1$, $p = .83$, $f^2 = 0.10$. In addition, participants rated liking the actor ($M = 5.05$, $SD = 1.06$) significantly above the midpoint (4) of the scale, where higher scores meant more liking $t(82) = 9.03$, $p < .001$, $d = 0.99$. This indicated that participants rated the actor as relatively likable.

Ratings on the perceived mood of the actor showed no significant main effect of gesture in video, $F(2, 80) = 2.40, p = .10, f^2 = 0.25$. Also, participants rated the perceived mood of the actor ($M = 4.78, SD = 0.88$) significantly above the midpoint (4) of the scale, $t(82) = 8.07, p < .001, d = 0.89$. These results suggested that participants perceived the actor to be in a positive mood. Together with the rating of liking of the actor, these findings suggest that this positive perception was not influenced by the behaviour of the actor.

3.3.3.3 Discussion

Experiment 3 replicated the finding of a nonconscious mimicry effect, and showed that the effect appears to generalise to the new cheek-rubbing and ear-touching gestures. In line with the predictions made, participants expressed cheek-rubbing behaviour at a higher rate when the actor performed cheek-rubbing, compared to those who were shown the actor performing no gestures. Similarly, ear-touching behaviour was expressed at a higher rate when ear-touching was performed by the actor, relative to the ear-touching expressed in the no gesture condition. Importantly, the finding that perceiving cheek-rubbing or ear-touching behaviour did not elicit more general face-rubbing behaviour further suggests that nonconscious mimicry was specific to the more localised new gestures, and was not a proxy for more general face-rubbing mimicry.

There were, however, certain limitations to consider with regard to the behavioural mimicry data. Due to issues with the baseline measure and the distribution of participant behaviour, the plans for analysing participants' mimicry behaviour had to be adjusted. It was anticipated that the one-minute pre-experiment baseline measure of participants' cheek-rubbing and ear-touching behaviour would be used as an additional control for initial group differences in behaviour. However, because this baseline measure showed exceedingly high levels of gesture expression it was discarded as a covariate factor. The exclusion of the baseline measure as a covariate and employing the adjusted t-statistics to account for slightly non-normal data distribution potentially resulted in a loss of power to detect a mimicry effect. Indeed, the finding that mimicry occurred statistically above the target behaviour expressed in the control condition was based on one-tailed significance values. Although this was not necessarily problematic due to the a priori predictions made

about participants' behaviour, caution is needed in interpreting the magnitude of the mimicry observed.

In addition, the awareness check measure showed that the percentage of participants explicitly reporting the target gestures as unusual was greater than expected (25%), as was the number of participants able to guess the main aim of the study. Although the direction of behavioural means showed a similar pattern when those who cited the gesture as unusual were removed from the behavioural analyses, this level of awareness is potentially problematic. Bargh and Chartrand (2000) have suggested that when examining automatic effects, if over approximately 5% of participants are reporting awareness of the prime (e.g., target gesture) or, more importantly, the intended influence of that prime (e.g., mimicry), it is likely that the wider tested population may have some degree of awareness. The localised nature of the gestures manipulated may have led to a greater than expected percentage of participants reporting the cheek-rubbing and ear-touching gestures as unusual. Furthermore, this underscores the notion that manipulating general face-rubbing behaviour may be more appropriate in future examination of the mimicry effect. With these limitations in mind, the results of Experiment 3 do suggest that mimicry behaviour generalises to additional target gestures not commonly used in the literature, and that the effect shows some degree of sensitivity by the localised nature of participants expression of mimicry. Interestingly, the direction of means provisionally suggest that the cheek-rubbing behaviour was expressed by participants to a greater degree than the ear-touching gesture, regardless of gesture condition. However, when comparing mimicry behaviour (gesture present in the video) to control behaviour, ear-touching mimicry appears to show a proportionally higher rate of the target behaviour relative to ear-touching in the control condition than does cheek-rubbing mimicry. Speculatively, this could suggest that some gestures are more readily mimicked than others. This potential boundary condition and future avenues of research to directly test this possibility are discussed further in the next section.

3.4 General Discussion

The primary aim of Experiments 2 and 3 was to establish whether nonconscious mimicry occurs in relation to an experimentally comparable control condition and to demonstrate the generalisability of the mimicry effect to alternative gestures. In addition, the

experiments reported in the chapter also aimed to further explore the way in which two different perceptual characteristics of the target gestures; namely, exposure duration and the type of gesture, influenced the degree of nonconscious mimicry expressed by participants. The following section will discuss possible explanations for the results of Experiments 2 and 3, as well as their implications for the current automatic behaviour literature. Following this, the alterations made to the refined mimicry paradigm will be discussed with regard to the findings in the chapter, and possible modifications that may be needed for future experiments.

Demonstrating Mimicry Behaviour

The refinement of the mimicry paradigm was successful in establishing the mimicry effect employing the commonly used face-rubbing behaviour as a target gesture. Importantly, by implementing an experimentally comparable control condition, the mimicry observed in Experiment 2 can be taken as evidence that the face-rubbing mimicry expressed was at greater levels than would typically be observed in the same interaction context where there was no opportunity to mimic. This type of comparison as a measure of nonconscious mimicry has only been demonstrated on one previous occasion in the literature (van Baaren et al., 2006). However, the results from Experiment 2 extend those found by van Baaren et al. (2006). Specifically, the authors demonstrated an effect of mimicry behaviour relative to a control condition, and that mimicry only occurred under certain affective conditions. Experiment 2 is the first study to date, to my knowledge, which simply shows the effect of being exposed to a target gesture on participant behaviour, relative to exposure to no gestures within a similar experimental context.

Results from Experiment 3 replicated the finding of nonconscious mimicry behaviour, distinguishable from control behaviour. Moreover, the evidence suggested that nonconscious mimicry generalised to alternative target gestures (cheek-rubbing and ear-touching) beyond the few typically manipulated in the nonconscious mimicry literature. Importantly, Experiment 3 provided evidence that the perception of cheek-rubbing and ear-touching led to a greater tendency to express these specific gestures, and was not a remnant of the occurrence of more general face-rubbing.

The two characteristics of the target gestures examined in this chapter, specifically duration of exposure and gesture type, contributed to a better understanding of the nature of the mimicry effect. Results from Experiments 2 and 3 suggest these factors of the target primes, previously shown to influence other processes which are proposed to occur via the perception-behaviour link (Bargh et al., 1986; Dijksterhuis & van Knippenberg, 1998; Dijksterhuis et. al, 2000), may not influence nonconscious mimicry in a similar manner. The duration of exposure and type of target gestures and their influence on mimicry behaviour will be discussed in turn.

Duration of Exposure to Target Gestures

Contrary to predictions and previous evidence from automatic trait and stereotype priming behavioural effects (Devine, 1989; Dijksterhuis & van Knippenberg, 1998), Experiment 2 indicated that increased exposure to the target gestures did not significantly increase the amount of mimicry observed. The discrepancy between the results in Experiment 2 and previous findings in the automatic behaviour literature is potentially due to the differences in the way in which these primes activate related constructs. Specifically, traits and stereotypes perceived by individuals can lead to the activation of numerous constructs and behaviours linked to a single trait or stereotype prime (Wheeler & DeMarree, 2009). Presumably, the increased exposure to these primes potentially allows for a greater spread of activation (Bodenhausen, Macrae, & Hugenberg, 2003) to various related behaviours, judgements and impressions in line with the trait or stereotype. This greater activation to the numerous constructs may lead to greater effects on subsequent processing and behaviour. Speculatively, behavioural mimicry may be viewed in a less ambiguous way. For instance, perception of face-rubbing would not be expected to be linked to a large number of behavioural representations. Thus, increased exposure may not affect target behaviour to the same extent in mimicry's case because comparatively fewer mental representations are activated via perception.

There were also other potential design related factors in Experiment 2 that may have led to the finding that the duration of exposure to target gestures did not influence mimicry. The sample size taken was highlighted as potentially not providing the power needed to detect the effect of exposure duration on mimicry behaviour. In addition, the manner in which duration of exposure was manipulated needs to be considered. Playing the stimulus videos

twice did allow for the same frequency per minute of face-rubbing and the quality of the gestures (e.g., exact same face-touches) to be presented in both exposure conditions. This allowed for the consistency of gesture presentation between the two exposure conditions to be kept constant. However, it is possible that repeating the same three and a half minute video clip in the two exposures condition caused participants to not attend as closely, as when compared to an alternative of video recording the actor for a longer period of time, as no new information was being given in the repeated photo-description. Nonetheless, the advantage of presenting the same rate of target behaviour between the two exposure conditions outweighs this potential issue. Specifically, it allowed for a more direct comparison of participants' behaviour between the two different exposure conditions and removed the potential confound of exposing participants to a variable quality of target gestures.

Type of Gesture

Experiment 3 found that mimicry behaviour can extend to alternative, more localised, gestures. The localised nature of the two new gestures also implies a degree of sensitivity in the mimicry effect. It appears that the effect is able to differentiate the more subtle cheek-rubbing and ear-touching behaviour from more general face-rubbing behaviour, mirroring similar findings of fine motor automatic behavioural effects in imitation (Brass et al., 2001; Berthenhal et al., 2006; Catmur & Heyes, 2010). The demonstration that mimicry generalises to a new set of gestures highlights the flexible nature of mimicry. However, the pattern of means found in Experiment 3 tentatively suggests some gestures may be more readily expressed than others. Considering the possibility that different gestures may occur at different rates, would it be possible for mimicry may occur at different rates for different behaviours? Theoretically, this possibility is feasible. For instance, Dijksterhuis and colleagues (2000) have pointed out that automatic prime-to-behaviour effects can be viewed as a type of behavioural adjustment, that is, primes adjust ongoing behaviour. In addition, within the imitation literature it has been proposed that regularly used behaviours may have stronger associations linking perception to motor representations for that behaviour (Haslinger et al., 2005; Heyes, 2001).

However, there are certain limitations to the design employed in Experiment 3 which make statistically comparing the relative difference in cheek-rubbing mimicry and ear-touching

mimicry expressed difficult. The primary limitation of this design being the between-participant manipulation of gesture in the stimulus video. In the imitation literature, one way of quantifying this type of comparison is to calculate an index of automatic imitation. This has been done by taking an index score of incompatible trials (where higher reaction times are predicted) minus compatible trials (where lower reaction times are predicted) to demonstrate differences in the magnitude of imitation across conditions (e.g. Leighton et al., 2010). However, a key difference between this type of design and the design employed in Experiment 3 is that in the imitation paradigm all participants are exposed to incompatible and compatible trials (e.g. within-participant design). If a similar index score were calculated for Experiment 3 (e.g. cheek-rubbing – ear-touching behaviour), it would not directly compare differences in *mimicry* behaviour. For instance, participants in the gesture present conditions only saw one target gesture, thus there would be no direct comparison of mimicry of cheek-rubbing relative to mimicry of ear-touching behaviour. To better understand this potential boundary condition, and to directly test whether there may be a more robust tendency to mimic certain gestures more so than others, future research should expose participants to both gestures in a within-participant design as in the imitation literature (See Chapter 6 for design discussion). However, the finding in Experiment 3 that mimicry can generalise to these alternative gestures provides a good starting point for testing the possibility that general variation in the expression of these different gestures may influence mimicry behaviour.

Paradigm Refinement

It is likely that the demonstration of nonconscious mimicry in this chapter stems from several amendments made to the mimicry paradigm; specifically the reduction of target gesture frequency presented to participants in the stimulus videos and the new experiment task introduced. Conversely, the introduction of the pre-experiment baseline measure within the refined paradigm was less successful. Results across the two experiments showed that the one minute pre-experiment measure of participants' behaviour was substantially higher than behaviour expressed in the photo-description task, regardless of the gesture shown in the stimulus video. One explanation for this that must be considered is that the photo-description task is in some way suppressing gesture expression across participants. However, this explanation seems unlikely considering that greater levels of gesture expression following exposure to the target gestures, relative to a control condition,

was demonstrated and replicated within this chapter. If it was the case that the mimicry manipulation employed in the current chapter suppressed behaviour in general, then one would expect behaviour to be suppressed across all conditions.

The alternative explanation regarding the baseline measure given at the end of Experiment 2 appears to be in line with the broader findings of this chapter. Specifically, the implementation of the photo-description task in the present mimicry paradigm provided a longer period of time to measure participant behaviour (i.e., 7.5/11 minutes versus 4 minutes in Experiment 1b). Furthermore, the photo-description task provided a more interactive task to measure behaviour. Arguably, many of these changes contributed to the successful demonstration of mimicry behaviour. Importantly, these changes imply that a baseline that measures participant behaviour over several minutes may provide a more balanced measure of participant behavioural tendencies. In addition, introducing a task for participants to engage in during the baseline measure, similar to the photo-description task, may ameliorate the possibility that increased fidgeting behaviour is artificially increasing the baseline measure. For example, being involved in a task related to the subsequent interactive photo-description task would conceivably provide more experimentally comparable situations to measure baseline and experiment period behavioural tendencies than being left to wait alone in a testing room, especially in front of a video camera. Accordingly, Chapter Four will implement these changes in the refinement of the mimicry paradigm.

Considering the more successful paradigm refinements of the chapter, the first being the frequency per minute the actor performed the target gestures were substantially reduced. This coupled with presenting one gesture, rather than two simultaneously, potentially led to the actor's overall behaviour being perceived as more natural and drew less direct attention to the target behaviour. Data from the funnelled debrief supports this view, indicating a discernible improvement in participant's reporting the actor's behaviour as unusual and their suspicions of the main aim of the experiment task. Interestingly, a greater percentage of participants reported instances of awareness in Experiment 3 (25%) than in Experiment 2 (4.4%). One possibility for the higher levels of awareness of target gestures found in Experiment 3 was that all participants were exposed to the stimulus videos twice, thus were exposed to a greater number of target gestures. However, this seems unlikely as the two exposures condition in Experiment 2 did not elicit awareness levels to the same extent.

Rather, the perception of repetitive touches to a small portion of the face presumably attracted more attention in Experiment 3 as compared to the more varied display of touches around a larger area, as with the general face-rubbing gesture in Experiment 2. However, even with this increase of awareness in Experiment 3, the results suggest that nonconscious mimicry of the two new gestures was still observed. Comparatively, the results of Experiment 1a and 1b indicated that nonconscious mimicry was not observed due to acute levels of awareness of the target gestures. From the evidence gathered it is currently unclear precisely what influence the level of awareness has on nonconscious mimicry behaviour. As in the current experiments, research to date has primarily used the self-report funnel debrief to gauge participants awareness of target gestures (e.g., Ashton-James et al, 2007; Bailenson & Yee, 2005; Chartrand & Bargh, 1999; Yabar, et al., 2006). Arguably, a stronger test of the role of awareness would be one that directly assesses the effect of awareness on nonconscious mimicry behaviour.

The second refinement of the paradigm, adapting the commonly used photo-description task (Ashton-James et al., 2007; Chartrand & Bargh, 1999; Cheng & Chartrand, 2003; van Baaren et al., 2004b; Yabar et al., 2006) appears to provide a successful cover story for the mimicry paradigm. Importantly, within this new task it was checked that participants reported perceiving the new actor in the stimulus videos positively and reported their own emotional state as relatively positive across gesture conditions. These findings show that pre-conditions for mimicry, such as positive mood and liking (see Dalton & Chartrand, 2009 for review), were present in this paradigm. Interestingly, in both experiments participants reported an increase in feelings of nervousness at the end of the photo-description task, compared to the start of the experiment. Although this increase was attributed to participants' knowledge of being video-recorded (George & Stopa, 2008); across both studies participants were not reporting an excessive amount of anxiety and this did not appear to impede the demonstration of nonconscious mimicry.

The adapted photo-description task potentially provided communicative qualities one would be more likely to encounter in a social interaction (e.g., listening to another person speak about a photograph then describing a similar nature photograph, discussing many of the same topics as previously heard, to another future participant). An experiment task that incorporates this type of interaction quality may be needed to demonstrate nonconscious mimicry. Indeed, evidence suggests that mimicry plays an important role in facilitating

smooth and coordinated interactions (e.g., Ashton-James et al., 2007; Chartrand & Bargh, 1999; Lakin & Chartrand, 2003; van Baaren et al., 2004b), so it is unsurprising that mimicry may be more likely to occur in a task with a greater focus on interaction. However, typical interactions are rarely simple (Gilbert, Pelham, & Krull, 1988). Individuals must attend to various components going on within an interaction, such as listening and providing appropriate responses, monitoring cues from an interaction partner and choosing what to attend to or discount within the environment. The fact that mimicry provides such beneficial consequences in potentially cognitively taxing situations may suggest that nonconscious mimicry is efficient, requiring little to no cognitive resources to occur. However, the efficiency of mimicry behaviour remains empirically untested.

Importantly, since a suitable paradigm has been identified to further examine mimicry, one of the primary aims of this thesis can now be pursued, namely to investigate the automaticity of nonconscious mimicry. As highlighted above, the efficiency and awareness criteria appear to provide an excellent starting point to examine the automatic nature of mimicry. Chapter Four will begin to address this aim, by investigating the efficiency of mimicry as an automatic effect. Chapter Five extends this by directly examining the awareness criterion of mimicry's automaticity.

Chapter Four:

Investigating the Efficiency of Mimicry as an Automatic Behaviour

4.1 Introduction

The previous chapter demonstrated that nonconscious mimicry of face-rubbing behaviour occurs relative to an experimentally similar control condition. This finding extends previous evidence of nonconscious mimicry using a similar experimental comparison (van Baaren, Fockenberg, Holland, Steenaert, & van Knippenberg, 2006) by demonstrating the effect in relation to an equivalent control condition without manipulating additional social or cognitive moderating factors. In addition, the previous chapter showed that the mimicry effect can generalise to alternative, localised, gestures. However, the amount of exposure duration to target gestures did not appear to significantly influence the extent to which mimicry occurred. Given that a reliable mimicry paradigm has been established earlier in the thesis, this chapter will focus on the *process* by which mimicry occurs.

Many researchers have alluded to the automatic nature of mimicry (Bailenson & Yee, 2005; Bargh & Ferguson, 2000; Chartrand & Bargh, 1999; Karremans & Verwijmeren, 2008; Lakin, 2006; Lakin & Chartrand, 2003; Lakin, Chartrand, & Arkin, 2008; Martin, Gueguen, & Fischer-Lokou, 2010; Tanner, Ferraro, Chartrand, Bettman, & van Baaren, 2008; van Baaren et al., 2006). However, it is currently unclear which of the four main criteria of automaticity mimicry behaviour exhibits. This chapter seeks to begin identifying the criteria by which mimicry can be considered automatic.

4.1.1 Automaticity of Mimicry

The initial proposal that nonconscious mimicry is an automatic effect (Chartrand & Bargh, 1999) suggests that the mere perception of an individual performing a gesture automatically increases the likelihood of the perceiver engaging in that behaviour. Automatic processes are defined by Bargh (1994) as those that exhibit one or more of four fundamental criteria, namely, operating without awareness, without intention, without control and with high efficiency.

Applying these criteria to nonconscious mimicry, operating without awareness refers to an individual's lack of conscious awareness that perceived gestures have influenced their own behaviour (Chartrand, 2005). Thus far in the literature this lack of awareness has been demonstrated through the use of retrospective measures of self-reported awareness. Mimicry has also been inferred to occur without intention (Chartrand & Bargh, 1999; Lakin & Chartrand, 2003; Vrijnsen, Lange, Becker, & Rinck, 2010) and without control (Lakin & Chartrand, 2003), in that the mere perception of behaviour can activate or start mimicry behaviour in the absence of the goal or will to mimic, and once started individuals are general unable to stop or control mimicry behaviour. The efficiency of mimicry, namely, that mimicry behaviour needs little or no cognitive resources to occur, has received less direct attention (Dalton, Chartrand, & Finkel, 2010). However, research on imitation effects, which is proposed to share a similar underlying mechanism to nonconscious mimicry, suggests that behaviour matching effects show little to no detriment when cognitive resources are limited (Brass, Derrfuss, & von Cramon, 2005; van Leeuwen, van Baaren, Martin, Dijksterhuis, & Bekkering, 2009).

In nonconscious mimicry research, the effect has been classified as automatic primarily by fulfilling the (un)awareness criterion of automaticity (see Chartrand & van Baaren, 2009 for review). Research to date has not directly explored the remaining three criteria of automaticity (e.g., operating without intention, without control, and with high efficiency) with regard to an individual's tendency to express mimicry behaviour, yet the effect has been labelled automatic as an umbrella term. The current approach in defining nonconscious mimicry as an automatic effect presents two potential issues. Specifically, it is unclear whether retrospective self-report of awareness alone is sensitive enough to demonstrate that mimicry behaviour fulfils the unawareness criterion of automaticity. In a broader sense, the degree to which mimicry exhibits automatic or controlled properties remains uncertain because only one of the four automaticity criteria, operating without awareness, has been explored. Recent opposition to this generalised approach in diagnosing the automatic or controlled nature of a process has argued that many, if not all, 'automatic' processes are not purely automatic (Chartrand & Fitzsimons, 2011; Kihlstrom, 2008; Moors & De Houwer, 2006). In other words, an automatic effect can exhibit degrees of automaticity, such that it may meet some if not all of the four criteria discussed above (Bargh, 1994) and still be considered automatic. Thus, a feature-based approach, put forward by Moors and De Houwer (2007) should be adopted. Distinctively, a feature-based

approach stipulates that when diagnosing the automatic features of an effect, one should directly examine the four criteria separately within the effect of interest. This method allows for far more clarity and precision in classifying the degree to which a process exhibits automatic properties.

As highlighted at the end of Chapter Three, the successful refinement of the mimicry paradigm raised further questions regarding the efficiency and the role of awareness in demonstrating nonconscious mimicry. Thus, the focus of the remainder of this thesis will be to begin a separate examination of these two automaticity criteria. This chapter aims to follow a feature-based approach (Moors & De Houwer, 2006; 2007), as described above, to directly examine the efficiency criterion with regards to nonconscious mimicry's automaticity. Chapter Five will follow up the uncertainty of the role of awareness in mimicry behaviour.

4.1.2 Efficiency of Automatic Processes

A process or behaviour that meets the efficiency criterion is one that needs minimal attentional resources to occur (Bargh, 1994; Moors & De Houwer, 2006). The most common approach in the automatic priming literature is to view attentional resources from a capacity standpoint, which stipulates that there is a finite quantity of resources available for any process requiring temporary storage and information processing to occur (Baddeley, 1997). In order to gauge the amount of attentional resources that a given process or behaviour consumes, rapid presentation of target stimuli, reaction time measures and dual-task paradigms are often employed. The first two approaches use a fast vs. slow delineation. This has been applied to the presentation of target information, such as stereotypic judgements are not disrupted by the rapid presentation of stereotypic primes (e.g., Pratto & Bargh, 1991; van Knippenberg, Dijksterhuis, & Vermeulen, 1999). This fast vs. slow methodology has also been employed as a measurement of target behaviour, for example, showing that reaction times are faster to perform imitative behaviour compared to non-imitative behaviour (e.g., Brass, Bekkering, & Prinz, 2001). In both presentation and measurement approaches, the assumption is that efficient processes can start and run without being hampered by other on-going processes, and that this can be exhibited by the ability to process and perform faster than inefficient processes (Moors & De Houwer, 2006; Smith & Lerner, 1986).

An alternative means of assessing the efficiency of a process is the use of dual-task paradigms. For instance, participants complete a primary task, such as a stereotypic word completion task (Gilbert & Hixon, 1991) or a stimulus-response compatibility task (van Leeuwen et al., 2009), in which the automatic process or behaviour is measured. However, by including a concurrent secondary task known to tax attentional resources, such as digit rehearsal tasks (Bargh & Tota, 1988; Gilbert & Hixon, 1991) or an N-back task (van Leeuwen et al., 2009), researchers have found that when attentional resources are scarce efficient processes (e.g., stereotype activation and imitation) show little to no impairment. Importantly, the dual-task method does not rely on reaction time measures to gauge the efficiency of a process or behaviour. Given it is the amount of mimicry behaviour participants express (e.g., the frequency or duration) that is of interest, not the time it takes to express that behaviour, the use of a dual-task paradigm seems more applicable to investigate the efficiency of nonconscious mimicry.

The only consideration of efficiency in the mimicry effect thus far has been to examine the consequences that arise due to being mimicked. Dalton et al. (2010) found that when individuals were mimicked they showed less impairment in subsequent or concurrent tasks requiring attentional and self-regulatory resources. This led the authors to propose that being mimicked may spare self-regulatory resources and make an interaction more efficient. Notably, the majority of the identified consequences that arise from being mimicked have also been shown to moderate the amount of mimicry and individual expresses (Ashton-James & Chartrand, 2009; Chartrand & Bargh, 1999; Cheng & Chartrand, 2003; van Baaren, Horgan, Chartrand, & Dijkmans, 2004a). Although the often bi-directional relationship between mimicry and social/cognitive factors is in favour of mimicry's efficiency, it remains unclear if the expression of mimicry behaviour itself is efficient.

The imitation literature suggests that instructed behaviour matching effects do exhibit efficient characteristics. There is a robust finding in the literature that shows that executing an action is facilitated (e.g., faster reaction times) when imitating the observed action, and interference effects (e.g., slower reaction times) arise when executing a non-imitative action (e.g., Brass, Bekkering, Wohlschlagel, & Prinz, 2000; Craighero, Bello, Fadiga, & Rizzolatti, 2002; Leighton, Bird, Orsini, & Heyes, 2010). This suggests that imitation is efficient, and when that tendency is suppressed some degree of cognitive resources are

needed. Moreover, the finding that this facilitation effect of imitating an action is not impaired while completing a second concurrent task (van Leeuwen et al., 2009) further suggests that imitation meets the efficiency criterion of automaticity. Considering the strong parallels between instructed imitation and nonconscious mimicry (see Chapter One for review) and the evidence for the efficiency of related automatic prime-to-behaviour effects (Gilbert & Hixon, 1991; van Knippenberg et al., 1999), the expression of mimicry behaviour would similarly be expected to be efficient in nature. Thus, Experiments 4 and 5 employed a dual-task paradigm to examine the influence of attentional demands on the expression of nonconscious mimicry. It was predicted that mimicry behaviour would remain unaffected under conditions in which cognitive resources were taxed.

In addition to investigating the efficiency of mimicry, the present chapter aim to address issues encountered with the baseline measure employed in Experiments 2 and 3. It was suggested in Chapter Three that the one minute pre-experiment measure showed such elevated levels of target behaviour because of the context in which it was taken and the relatively short period of time that behaviour was measured. Thus, a revised baseline measure was introduced in this chapter, which provided a longer period of time to measure baseline face-rubbing behaviour while participants were engaged in a similar task to the one in which mimicry behaviour was measured. Furthermore, continuing the previous chapter's research on the conditions under which mimicry occurs, Experiment 4 had the secondary aim of examining the time course of the effect. Previous studies employing video-based mimicry paradigms have primarily measured participant behaviour only while the actor is visually present performing the target gesture(s) (Castelli, Pavan, Ferrari, & Kashima, 2009; Chartrand & Lakin, 2003; van Baaren et al., 2004a; van Baaren et al., 2006; Yabar, Johnston, Miles, & Peace, 2006). Little is known about the decay rate of mimicry behaviour after the initial exposure to target gestures. Is there, for instance, a stop mechanism for perception-induced action once the perceived action is no longer present, in the same way as automatic goal-induced action once the goal is achieved (Forster, Liberman, & Friedman, 2007; Lakin & Chartrand, 2003)? Evidence from the social priming literature shows that primed social constructs continue to influence behaviour for up to fifteen minutes (Dijksterhuis & van Knippenberg, 1998), suggesting this type of automatic behaviour does not decay rapidly after priming. Further elucidation of the boundary conditions of mimicry behaviour, such as the decay rate, provides a starting point to explore this question as well as helping to discern the optimal conditions to

demonstrate the effect. Therefore, the time course of mimicry behaviour after exposure to target gestures was also explored. In light of the evidence for minimal decay effects in similar prime-to-behaviour effects (Dijksterhuis & van Knippenberg, 1998) it was anticipated that the expression of mimicry would remain relatively constant and show little decay after perception of the target gesture in the stimulus video.

4.2 Experiment 4

4.2.1 Overview

Experiment 4 aimed to directly assess the efficiency of nonconscious mimicry. This was examined by measuring the extent to which mimicry was expressed as a function of the cognitive resources available to the individual. A dual-task paradigm employing a digit rehearsal task similar to that of Gilbert and Hixon (1991) was introduced. This particular task was chosen primarily because it provided a working memory task that would not interfere with the photo-description task used in the mimicry paradigm developed in this thesis. Specifically, rehearsing a number string should not interfere with the audio component of the photo-description, or participant's ability to visually encode the target gestures performed by the actor. Therefore, participants were asked to rehearse either a resource consuming random sequence eight-digit number (Gilbert & Hixon, 1991), or a less demanding digit sequence whilst completing the photo-description task employed previously in this thesis (e.g., Experiment 2).

A main effect of gesture was predicted, such that participants exposed to the target face-rubbing gesture would express significantly greater levels of face-rubbing behaviour compared to participants exposed to no gestures. Since mimicry behaviour was anticipated to be efficient, this pattern of behaviour was expected for both the highly demanding and less demanding cognitive load conditions. Thus, no main effect of cognitive load or interaction between gesture condition and cognitive load was expected. In addition, it was predicted that mimicry of the target gesture would not decay rapidly after exposure to the stimulus video. Thus, following exposure to the target gesture in the stimulus video participants were expected to consistently express greater levels of face-rubbing behaviour over the description of four photographs, compared to participants who were exposed to no gestures.

4.2.2 Method

4.2.2.1 Participants and Design

Eighty-seven undergraduate psychology students (71 females, 16 males; age $M = 20.20$, $SD = 3.91$) were randomly allocated to a 2 (gesture: no gesture vs. face-rubbing) x 2 (cognitive load: low vs. high) between-participants design. Participants received partial course credit as payment for participation.

4.2.2.2 Procedure

The same procedure and stimulus videos used in Experiment 2 were employed, with the following exceptions. Participants were given additional information in the cover story that the study was investigating successful communication on sets of photographs via video, and whether this varies as a function of completing more than one task at a time. In addition, the one minute pre-experiment baseline measure was revised. All participants heard a three minute audio photo-description example, in which they listened to a pre-recorded script (that they were told was performed by a previous participant) describing two photographs that were concurrently displayed on the computer screen.

After the baseline measure, all participants were instructed that they would be shown an eight-digit number on the computer screen. It was stressed that participants needed to continually rehearse this number, as they would be asked to recall and write it down at the end of the study. However, it was also pointed out they needed to pay attention to the person in the video clip as they would be asked questions about the person as well at the end of the study. This was to ensure all participants fully attended to the video. All of the participants randomly assigned to the high load condition received the same demanding random digit sequence (i.e., 7, 8, 4, 1, 6, 3, 5, 2), whereas all of the participants assigned to the low load condition received the same less demanding sequenced number (i.e., 1, 2, 3, 4, 5, 6, 7, 8). The eight-digit number appeared on the computer screen for 30 seconds for the participants to view and rehearse. Once the number sequence disappeared from the screen, all participants were prompted to repeat the number shown to them out loud to make certain they were rehearsing the correct number before starting the photo-description task.

The photo-description task was identical to the procedure in Experiments 2 and 3, with two exceptions. Firstly, the video stimulus was presented once (e.g., one video exposure) rather than twice.⁹ All participants then described the two photographs used in the previous chapter; however, those placed in the low load condition described an additional two photographs in order to examine the decay rate of face-rubbing behaviour. After completing the photo-description task, all participants completed the dependent measures described below before being debriefed and thanked for their participation.

4.2.2.3 Dependent Measures

Measures of affect (SAM measure), awareness check and participant behaviour were taken, all of which were identical to those previously used in Experiments 2 and 3. Two new manipulation check measures regarding the digit rehearsal task were included: a cognitive load manipulation check and the perceived difficulty of the task.

Cognitive Load Manipulation Check

After completing the photo-description task, participants were asked to recall and write down the eight-digit number shown to them at the beginning of the photo-description task. This acted as a manipulation check that participants followed the number rehearsal instructions. Employing the same a priori cut off as Gilbert and Hixon (1991), large errors in the digit recall were defined as incorrectly recalling four or more digits in the eight-digit sequence. Large errors suggested that participants may not have been continually rehearsing the digit sequence, and therefore that resources were not sufficiently taxed. It was not anticipated that large errors would occur due to the digit rehearsal task being too difficult, as Gilbert and Hixon (1991) found that only 7% of participants made large errors, and Salvucci and Betowska (2008) found that on average participants made three or less digit errors employing a similar rehearsal task.

⁹ There were concerns that the added time taken in employing the two video exposure method used in Experiment 3 could result in the memorisation of the digit sequence rather than continuous rehearsal, resulting in working memory resources being less taxed (Baddeley, 1997).

Perceived Difficulty of Task

Next, participants were asked to rate how difficult they found the video period and description period of the photo-description task on a seven point scale. The difficulty ratings provided an additional subjective manipulation check to ensure participants placed in the high load condition found the experiment tasks more difficult than those who were placed in the low load condition.

4.2.3 Results and Discussion

Awareness Check

Mimicry behaviour data was treated in the same way as in Experiments 2 and 3. Responses to the awareness check questionnaire were analysed, which showed 4.6% (4 out of 87 participants) explicitly stated that the gesture ‘face-rubbing’ was unusual. Within these four individuals who reported awareness of the actor’s face-rubbing behaviour, one participant guessed the main aim of the study and this participant was removed from further analyses.

Recall Manipulation Check

Digit recall scores were analysed to check that participants followed the digit rehearsal instructions and that attentional resources were sufficiently taxed. A digit error was considered to be any number not in the correct position of the original digit sequence. Results showed that 78 participants made no digit errors, five participants made two digit errors and three participants made more than four digit errors, all in the high load condition. The three participants who made more than four digit errors were excluded from further analyses (Gilbert & Hixon, 1991).

4.2.3.1 Behavioural Mimicry

Data from 83 participants balanced across the gesture and cognitive load conditions were included in the final analyses; four participants were removed from the analyses (one for guessing the main aim of the study and three for making digit recall errors). In order to check the reliability of behaviour coded as face-rubbing, 30% of participant video-recorded

sessions were double coded by a second coder blind to condition and the hypotheses of the experiment. The inter-rater reliability for participants' face-rubbing behaviour was high, $r = .90, p < .001, \alpha = 0.95$. Exploratory analysis revealed that the frequency per minute of face-rubbing expressed by participants was normally distributed. Exploratory analysis also found, overall, that the new pre-experiment baseline measure of participant face-rubbing behaviour ($M = 1.91, SD = 2.85$) was more comparable to the face-rubbing behaviour expressed during the photo-description task ($M = 1.35, SD = 1.72$), and that this was consistent across gesture and cognitive load conditions. Thus, the baseline measure was included in the behavioural analyses as a covariate.

Effect of Cognitive Load on Mimicry Behaviour

A 2 (gesture: no gesture vs. face-rubbing) x 2 (cognitive load: low vs. high) between participants ANCOVA was conducted on participants' frequency per minute face-rubbing behaviour. The baseline measure of face-rubbing behaviour was significantly related to participants' face-rubbing behaviour during the experiment period, $F(1, 78) = 41.76, p < .001, f^2 = 0.73$. After accounting for baseline face-rubbing behaviour, analysis revealed that there was no main effect of gesture in the stimulus videos, $F < 1, p = .73, f^2 = 0.04$, no main effect of cognitive load, $F < 1, p = .42, f^2 = 0.10$, and no significant interaction between gesture and cognitive load, $F < 1, p = .59, f^2 = 0.10$ (see Figure 4.1). Behavioural mimicry was not demonstrated, relative to the no gesture conditions, in either the low or high load conditions.

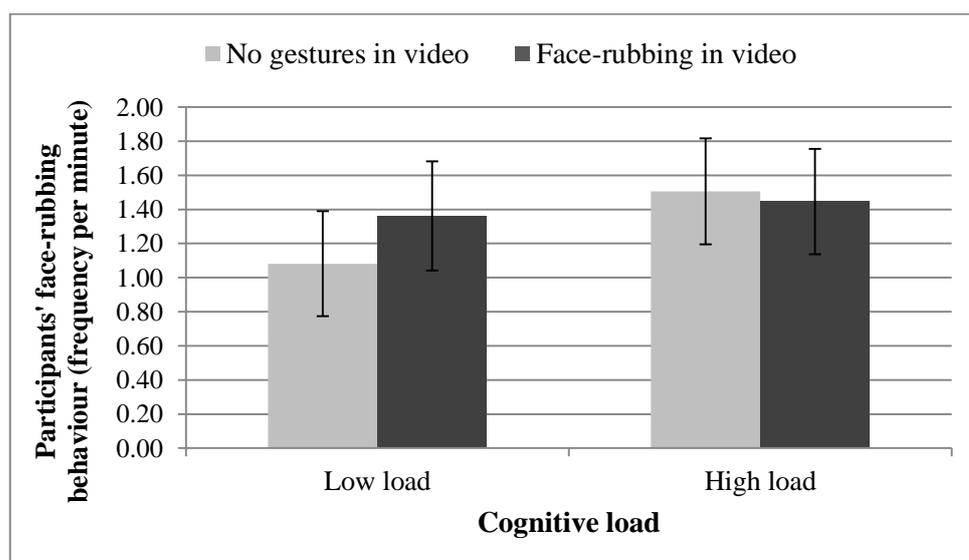


Figure 4.1. Marginal means for face-rubbing behaviour as a function of gesture video seen and cognitive load +/- 1 SEM.

Time Course of Face-Rubbing Behaviour

The behaviour of participants in the low load condition ($N = 41$), who described four separate photographs, was analysed in a 2 (gesture: no gestures vs. face-rubbing) x 4 (time: photo one vs. photo two vs. photo three vs. photo four) mixed ANCOVA, with time as the within-participant factor. Analysis revealed that the pre-experiment baseline was significantly related to participants' face-rubbing behaviour during the photo-description, $F(1, 38) = 4.32, p = .04, f^2 = 0.34$. After controlling for baseline face-rubbing behaviour, analysis showed no main effect of gesture, $F < 1, p = .96, f^2 = 0.01$, no main effect of time, $F < 1, p = .59, f^2 = 0.13$, and no significant interaction between gesture and time, $F(4, 38) = 1.96, p = .56, f^2 = 0.23$ (see Figure 4.2). Contrary to predictions, following exposure to the face-rubbing gesture in the stimulus video, participants did not express significantly greater levels of face-rubbing while describing the four photographs as compared to participants who were previously exposed to no gestures.

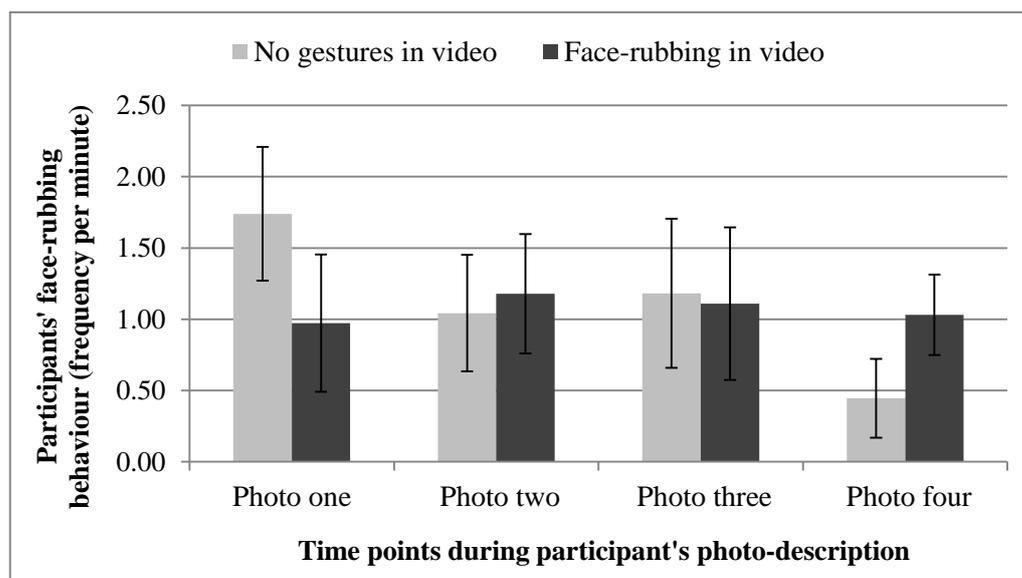


Figure 4.2. Marginal means of participant's face-rubbing behaviour in the low cognitive load group as a function of gesture condition and time across the experiment +/- 1 SEM.

4.2.3.2 Secondary Measures

Perceived Difficulty of the Experiment Task

Participants self-reported ratings of the perceived difficulty of the video period and photo-description period of the study were averaged together to create a difficulty rating index score ($\alpha = 0.80$). A 2 (gesture: no gesture vs. face-rubbing) x 2 (cognitive load: low vs.

high) between-participants ANOVA was conducted on the difficulty rating index. Analysis revealed no significant main effect of gesture, $F < 1, p = .95, f^2 = 0.01$. There was, however, a significant main effect of cognitive load, $F(1, 79) = 32.24, p < .001, f^2 = 0.30$. As expected, participants in the high load condition rated the photo-description task as more difficult ($M = 4.54, SD = 1.52$), compared to ratings in the low load condition ($M = 2.66, SD = 1.46$). The interaction between gesture and cognitive load was not significant, $F < 1, p = .67, f^2 = 0.05$.

SAM Measure

A 2 (time: pre-SAM vs. post-SAM) x 2 (gesture: no gestures vs. face-rubbing) x 2 (cognitive load: low vs. high) mixed ANOVA was conducted, with time as the within-participant factor. This analysis was conducted on each SAM item separately in keeping with the approach taken throughout the thesis. Analysis on the SAM pleasure scale (see Table 4.1) showed no significant main effect of gesture, $F < 1, p = .43, f^2 = 0.09$, no main effect of cognitive load, $F < 1, p = .49, f^2 = 0.08$, and no main effect of time, $F(1, 79) = 1.78, p = .19, f^2 = 0.15$. In addition, all interactions were not significant, $F < 1, ns, f^2 = 0.04$. Furthermore, both time points were significantly below the midpoint of the scale (3), pre-experiment $p < .001, d = 0.90$, and post-experiment $p < .001, d = 1.10$. This suggests all participants were relatively happy throughout the study, regardless of gesture and cognitive load condition.

Analysis indicated that ratings on the SAM arousal scale (see Table 4.1) showed no significant main effect of gesture, $F < 1, p = .60, f^2 = 0.10$, and no main effect of cognitive load, $F(1, 79) = 1.96, p = .17, f^2 = 0.16$. However, there was a main effect of time, $F(1, 79) = 6.27, p = .01, f^2 = 0.28$. Participants experienced an increase in feelings of nervousness after the photo-description task ($M = 2.80, SD = 0.93$), relative to ratings at the start of the experiment ($M = 2.55, SD = 0.77$). The interactions between time and gesture, $F(1, 79) = 3.01, p = .09, f^2 = .20$, time and cognitive load, $F(1, 79) = 2.08, p = .15, f^2 = 0.16$, gesture and cognitive load, $F < 1, p = .51, f^2 = 0.07$, and time, gesture and cognitive load, $F < 1, p = .78, f^2 = 0.04$, were, in all cases, not significant. Furthermore, both time points were significantly below the midpoint of the scale (3), pre-experiment $p <$

.001, $d = 0.93$, and post-experiment $p = .05$, $d = 0.23$. Thus, the increase in arousal did not indicate that participants were exceedingly anxious.¹⁰

Table 4.1

Mean Ratings on the SAM Pleasure and Arousal Scales as a Function of Time, Gesture in Video and Cognitive Load

	No gestures in video		Face-rubbing in video	
	Low load	High load	Low load	High load
<i>SAM Pleasure</i>				
Pre-measure	2.24 (0.70)	2.33 (0.48)	2.35 (0.81)	2.43 (0.93)
Post-measure	2.14 (0.66)	2.24 (0.63)	2.25 (0.64)	2.38 (0.81)
<i>SAM Arousal</i>				
Pre-measure	2.62 (0.80)	2.57 (0.60)	2.40 (0.88)	2.62 (0.81)
Post-measure	2.52 (0.87)	2.81 (0.98)	2.70 (0.98)	3.14 (0.85)

4.2.3.3 Discussion

Contrary to predictions, Experiment 4 showed that there was no evidence that participants expressed face-rubbing to a greater extent when exposed to the target gesture compared to participants exposed to no gestures in either the high or low load conditions. Thus, mimicry was not observed. This pattern of results was also shown in the examination of the time-course of the mimicry effect. Specifically, there was no difference in face-rubbing behaviour between the two gesture conditions across the eight minute period (e.g., the description of four photos) following exposure to the stimulus videos. Conclusions regarding the decay rate of mimicry were hampered by the weak evidence for mimicry behaviour. Speculatively drawing on the means illustrated in Figure 4.2, participant behaviour appeared to be more variable following exposure to no gestures as compared to exposure to the target gestures. This thought will be returned to in Chapter Six. One possible explanation for this pattern of results is individual variation between-participants, although this seems unlikely due to the use of the baseline covariate. The refined baseline measure used in Experiment 4 provided a satisfactory covariate measure to help account for individual variance in face-rubbing behaviour. While this does not fully explain the

¹⁰ The findings on the SAM pleasure and arousal measures replicate those found in Chapter Three and, thus, are not discussed further.

lack of mimicry observed, it does suggest that a pre-study measure taken in a more similar context as the experiment task (e.g., length of time and on-going task) may provide a more accurate measure of natural baseline behaviour in laboratory settings.

One possible explanation for that fact that Experiment 4 did not demonstrate mimicry is the working memory task introduced to the paradigm. It was expected that mimicry behaviour would occur in both the low and high load conditions, given that imitation effects have been shown to be efficient and as a proposed automatic effect. In the event that mimicry behaviour does not exhibit efficient characteristics, one would anticipate that greater levels of face-rubbing in the low load, gesture present, condition would be observed when compared to both the low load, no gesture, condition and the high load, gesture present, condition. However, neither of these differences was observed at statistically significant levels. The lack of mimicry in both the low and high load conditions may suggest that even minimal attentional demands could reduce mimicry behaviour. In order to support this conclusion, however, it is necessary to demonstrate that mimicry behaviour is reduced in the low load condition relative to the standard mimicry paradigm employed in Experiments 2 and 3 that successfully demonstrated nonconscious mimicry. This forms the basis of the next experiment.

A competing reason for the absence of mimicry is the amount of exposure to the stimulus video that was employed in the present experiment. It is possible that exposing participants to the stimulus video once, rather than twice (as was done in Experiments 2 and 3, where mimicry was successfully demonstrated), was not sufficient exposure to the face-rubbing gesture to induce mimicry behaviour above no gesture condition levels. If this is the case, employing a two video exposures design should elicit mimicry in both the standard paradigm and low load conditions. These competing hypotheses for the results of Experiment 4 are tested in the next experiment.

4.3 Experiment 5

4.3.1 Overview

Experiment 5 sought to examine two competing explanations to further clarify the results obtained in Experiment 4. To address the possibility that the previous findings were due to inadequate exposure, all participants were exposed to the stimulus videos twice. In

addition, to assess the possibility that even minimal attentional demands reduce mimicry behaviour, the low load condition was retained from Experiment 4 and a no load condition which mirrored the standard mimicry paradigm more closely (e.g., Experiment 2) was introduced.

If the findings in Experiment 4 were due to insufficient exposure to the target gesture, a main effect of gesture type would be predicted. Specifically, participants in both the no load condition and the low load condition would express significantly greater levels of face-rubbing behaviour when exposed to the target gesture compared to participants exposed to no gestures. However, if the results in Experiment 4 reflected a lack of mimicry due to the presence of the digit rehearsal task, then an interaction between cognitive load and gesture shown in the stimulus video was expected. Namely, participants in the no load condition would express greater levels of face-rubbing when exposed to the target gesture when compared to those exposed to no gestures. Conversely, participants in the low load condition would be expected to show reduced mimicry behaviour when exposed to the target gesture, expressing similar levels of face-rubbing as expressed by participants in the no gesture conditions. Notably, both hypotheses predict mimicry to occur in the no load condition. However, they diverge such that the exposure explanation predicts mimicry to occur in the low load condition and the attentional demands explanation predicts mimicry to be eliminated in the low load condition.

4.3.2 Method

4.3.2.1 Participants and Design

Ninety-two undergraduate and postgraduate students (71 females, 21 males; age $M = 22.60$, $SD = 6.48$) were randomly allocated to a 2 (gesture: no gesture vs. face-rubbing) x 2 (cognitive load: no load vs. low load) between-participants design. Participants received partial course credit or £3 as payment for participation.

4.3.2.2 Procedure

An identical procedure as was used in Experiment 4 was employed with the following exceptions. Rather than a high load condition, a no load condition was introduced in which participants were told they would complete the photo-description task without rehearsing a

digit sequence. In addition, all participants watched the stimulus videos twice before describing two photographs themselves. After completing the photo-description task, all participants completed the dependent measures described below before being debriefed and thanked for their participation.

4.3.2.3 Dependent Measures

Measures of affect, cognitive load manipulation check, awareness check and participant behaviour were taken, all of which were identical to those previously used in Experiment 4; with the exception of participants in the no load condition who were not given the cognitive load manipulation check as they were not given a digit sequence to rehearse.

4.3.3 Results and Discussion

Awareness Check

Mimicry behaviour data was treated in the same way as it was in Experiments 2-4. Three participants were excluded from the behaviour analyses for paying insufficient attention to the video during the experiment,¹¹ and an additional three participants could not be analysed and had to be excluded due to corrupted video files. The remaining 86 participants' responses to the traditional retrospective awareness check were analysed showing that 6.9% (6 out of 86 participants) explicitly stated that the gesture 'face-rubbing' was unusual. Within these six individuals who reported awareness of the actor's face-rubbing behaviour, three participants guessed the main aim of the study and were removed from further analyses.

Recall Manipulation Check

Digit recall scores were checked for errors; no participants made any errors on the digit recall task.

¹¹ These participants were identified during video coding as closing or diverting their eyes away from the computer screen for over half (more than 3.5 minutes) of the video stimulus presentation.

4.3.3.1 Behavioural Mimicry

To check the reliability of behaviour coded as face-rubbing, 30% of participants' video-recorded sessions were double-coded by a second coder blind to condition and the hypotheses of the experiment. The inter-rater reliability for participants' face-rubbing behaviour was high, $r = .84$, $p < .001$, $\alpha = 0.92$. Exploratory analysis revealed violations of normal distribution in the data; as a result three participants were removed as outliers on the basis that they were 2.5 standard deviations above the mean rate of face-rubbing behaviour (Upton & Cook, 2008; van Baaren et al., 2006), and the behavioural data was Log10 transformed. This corrected distribution violations. Exploratory analysis also found, overall, that the pre-experiment baseline measure of participant face-rubbing behaviour ($M = 1.02$, $SD = 1.22$) was relatively comparable to face-rubbing behaviour expressed during the photo-description task ($M = 0.81$, $SD = 0.78$), and this was consistent across gesture and cognitive load conditions. Thus, the baseline measure was included in the behavioural analysis as a covariate. To reiterate, a total of 12 participants were removed (three due to equipment malfunction, three for paying insufficient attention to the stimulus, three for guessing the main aim of the study and three as statistical outliers), leaving 80 participants balanced across the gesture and cognitive load conditions in the final analyses.

A 2 (gesture: no gesture vs. face-rubbing) x 2 (cognitive load: no load vs. low load) between participants ANCOVA was conducted on participants frequency per minute face-rubbing behaviour. The baseline measure of face-rubbing behaviour was marginally related to participants' face-rubbing behaviour during the experiment period, $F(1, 75) = 3.71$, $p = .06$, $f^2 = 0.22$. After accounting for baseline face-rubbing behaviour, analysis revealed that there was no main effect of gesture, $F < 1$, $p = .70$, $f^2 = 0.05$, no main effect of cognitive load, $F < 1$, $p = .93$, $f^2 = 0.01$, and no significant interaction between gesture and cognitive load, $F < 1$, $p = .54$, $f^2 = 0.05$ (see Figure 4.3). Thus, mimicry behaviour was not observed in either the no load or low load condition.

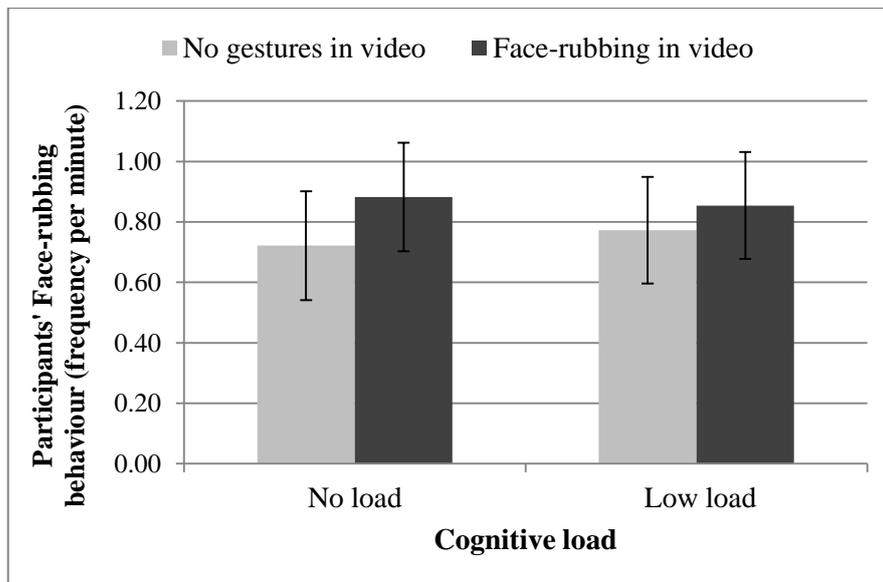


Figure 4.3. Marginal means for face-rubbing behaviour as a function of gesture video seen and cognitive load +/- 1 SEM (figure error bars are based on larger error estimates than were used for Log10 transformed analysis).

4.3.3.2 SAM Measure

A 2 (time: pre-SAM vs. post-SAM) x 2 (gesture: no gestures vs. face-rubbing) x 2 (cognitive load: no load vs. low load) mixed ANOVA was computed, with time as the within-participant factor. This analysis was conducted on each SAM item separately. Ratings on the SAM pleasure scale (see Table 4.2) showed no main effect of time, $F < 1$, $p = .65$, $f^2 = 0.05$; and no significant interactions between time and gesture, $F < 1$, $p = .88$, $f^2 = 0.02$, time and cognitive load, $F(1, 76) = 1.12$, $p = .30$, $f^2 = 0.12$, or a three-way interaction, $F < 1$, $p = .45$, $f^2 = 0.10$. Ratings did indicate that a marginal main effect of gesture, $F(1, 76) = 3.42$, $p = .07$, $f^2 = 0.21$, showing participants who saw no gestures ($M = 1.91$, $SD = 0.64$) rated themselves as marginally more happy than participants who saw the face-rubbing gesture ($M = 2.14$, $SD = 0.74$). There was also a marginal effect of cognitive load, $F(1, 76) = 3.42$, $p = .07$, $f^2 = 0.21$, indicating that participants given no number ($M = 1.92$, $SD = 0.71$) rated themselves as marginally more happy than participants given the low load number ($M = 2.14$, $SD = 0.63$). However, overall ratings were significantly below the midpoint (3) of the scale, pre-experiment $p < .001$, $d = 1.37$, and post-experiment $p < .001$, $d = 1.48$. These results suggested that participants were still relatively happy throughout the study.

Ratings on the SAM arousal scale (see Table 4.2) showed no main effect of gesture, $F < 1$, $p = .40$, $f^2 = 0.09$, and no main effect of cognitive load, $F < 1$, $p = 1.00$, $f^2 = 0.02$. There was, however, a significant main effect of time, $F(1, 76) = 6.95$, $p = .01$, $f^2 = 0.30$.

Participants experienced an increase in feelings of nervousness after the photo-description task ($M = 2.62$, $SD = 0.92$), relative to ratings at the start of the experiment ($M = 2.40$, $SD = 0.84$). In addition the interactions between time and gesture, $F(1, 76) = 1.26$, $p = .26$, $f^2 = 0.13$, time and cognitive load, $F(1, 76) = 2.90$, $p = .09$, $f^2 = 0.20$, gesture and cognitive load, $F < 1$, $p = .88$, $f^2 = 0.02$, and a three-way interaction, $F < 1$, $p = .78$, $f^2 = 0.03$, were all not significant. Both time points were significantly below the midpoint (3) of the scale, pre-experiment, $p < .001$, $d = 0.74$, and post-experiment, $p < .001$, $d = 0.43$. This suggests that participants were still relatively relaxed throughout the study.

Table 4.2

Mean Ratings on the SAM Pleasure and Arousal Scales as a Function of Time, Gesture in Video and Cognitive Load

	No gestures in video		Face-rubbing in video	
	No load	Low load	No load	Low load
<i>SAM Pleasure</i>				
Pre-measure	1.70 (0.57)	2.10 (0.72)	2.00 (0.80)	2.25 (0.79)
Post-measure	1.75 (0.55)	2.10 (0.64)	2.20 (0.83)	2.15 (0.49)
<i>SAM Arousal</i>				
Pre-measure	2.20 (0.77)	2.35 (0.88)	2.45 (0.89)	2.60 (0.82)
Post-measure	2.70 (0.66)	2.50 (0.89)	2.70 (1.22)	2.60 (0.88)

4.3.3.3 Discussion

In order to further clarify the results of Experiment 4, Experiment 5 investigated two competing hypotheses. The exposure explanation predicted a main effect of gesture shown in the stimulus video and, thus that mimicry would occur in the low load and no load conditions. Alternatively, the attentional demands explanation predicted an interaction between cognitive load and gesture shown in the stimulus video, such that mimicry would be eliminated in the low load condition and occur in the no load condition. However, there was no evidence for either a main effect of gesture or an interaction between gesture and load conditions. In addition, participants in the no load condition did not express

significantly higher rates of face-rubbing when exposed to the gesture as compared to those exposed to no gestures (although the means were in this direction), which was required to support either of these hypotheses. Thus, the results seem to discount the hypothesis that the results in Experiment 4 were due to inadequate exposure to the target gesture.

Likewise, in order to conclude that any attentional load reduces mimicry the results would need to show greater levels of face-rubbing (following exposure to the gesture) in the no load condition as compared to the low load condition. However, there were no significant differences between these two conditions. Therefore, the hypothesis that mimicry behaviour dissipates under conditions of minimal attentional demands was not supported in Experiment 5. Together these results suggest that there must be an alternative explanation responsible for the lack of mimicry demonstrated in Experiments 4 and 5, other than insufficient exposure to gestures or attentional demands.

The SAM measure and the awareness check showed comparable findings to Experiments 2-4. As such, changes in affect or awareness cannot explain the unexpected behavioural results. Although this may suggest a problem with the reliability of the mimicry paradigm, there is another more plausible explanation. This involves the procedural changes made to the mimicry paradigm. In the information given about the photo-description task, all participants were told that the experiment was a dual-task study (e.g., examining the effect of number rehearsal on video based communication), whereas the same task was framed with a focus on successful communication via video in the previous chapter. As these possibilities concern both Experiment 4 and 5, they will be further discussed in the following section.

4.4 General Discussion

The primary aim of the two experiments reported in Chapter Four was to employ a feature-based approach (Moors & De Houwer, 2007) and directly assess the efficiency of mimicry as an automatic behaviour. However, both Experiments 4 and 5 failed to demonstrate nonconscious mimicry above no gesture condition levels. Specifically, the results from Experiment 4 indicated that mimicry did not occur under conditions in which participants rehearsed a highly demanding digit sequence or when participants rehearsed a less

demanding digit sequence. Experiment 5 subsequently addressed two possible explanations for these results. One being that inadequate exposure to target gestures was responsible for not demonstrating mimicry, or the other possibility that even minimal attentional demands eliminates mimicry behaviour. However, when the exposure duration to the target gesture was doubled, mimicry was not replicated in the no load condition, nor was mimicry observed in the low load condition. Although these results make it difficult to reach a conclusion as to the extent to which mimicry is efficient, the current findings will be discussed in terms of their implications for the efficiency of mimicry and the sensitivity of mimicry behaviour to context cues.

The (In)Efficiency of Mimicry

The finding that mimicry was not demonstrated in either the high or low cognitive load conditions in Experiments 4 or 5 could indicate that the mimicry effect will disappear under even the most minimal attentional load (e.g., the rehearsal of a simple digit sequence). However, it is difficult to conclude this, given that mimicry was not reliably demonstrated in the no load or low load conditions. What are the implications of nonconscious mimicry exhibiting inefficient characteristics? Considering the proposed underlying mechanism of mimicry, the direct link between perception and behaviour posits that perception should automatically activate behavioural responses (Bargh, Chen, & Burrows, 1996; Dijksterhuis & Bargh, 2001). The digit rehearsal task may have interfered with the activation of behavioural representations, or the subsequent influence of this activation on observable motor behaviour. This would suggest that some degree of cognitive resources are necessary to translate that behavioural activation, via perception, to the actual expression of that behaviour. However, this would not necessarily suggest that mimicry is a controlled behaviour rather than an automatic behaviour (Bargh, 1994; Moors & De Houwer, 2006), as it may exhibit one or more of the remaining three criteria of automaticity.

The suggestion that mimicry is not efficient would be relatively surprising considering the evidence indicating that mimicry plays an important role in facilitating smooth and coordinated interactions (e.g., Ashton-James, van Baaren, Chartrand, Decety, & Karremans, 2007; Chartrand & Bargh, 1999; Lakin & Chartrand, 2003; van Baaren, Holland, Kawakami, & van Knippenberg, 2004b). Social interactions are rarely simple; for

example, an individual must attend to many internal cues, external cues and information during such an exchange (Gilbert, Pelham, & Krull, 1988). The fact that mimicry provides such beneficial consequences in cognitively taxing situations would suggest that the effect is efficient to some degree. Indeed, the direction of means across both experiments in Chapter Four does not necessarily support the explanation that reduced attentional resources directly influenced the tendency to express mimicry, relative to the no gesture conditions. Rather, the finding that mimicry was not observed in the present chapter seems more likely to be due to the methodological changes made to the mimicry paradigm: specifically, to the photo-description task by introducing the digit rehearsal element.

Attentional Focus

In contrast to the successful mimicry paradigms employed in Experiments 2 and 3, all participants in Experiments 4 and 5 were told a slightly different cover story to incorporate the digit rehearsal task. When mimicry was demonstrated in the previous chapter, participants were told that the photo-description task was about successful communication to others via video. As pointed out at the end of Chapter Three, this communicative aspect may be an important social quality necessary for a successful mimicry paradigm. The inclusion of the digit rehearsal task information in Experiments 4 and 5 may have changed the nature of the photo-description task, and possibly disrupted mimicry behaviour irrespective of cognitive demands.

The framing of the photo-description task may have shifted participants' attentional focus to aspects of the digit rehearsal task, rather than attending to the actor in the video and the interactive qualities of listening to and describing sets of photographs. Importantly, attentional focus dictates the extent to which perceived information is subsequently processed, consciously or unconsciously (Dijksterhuis & Aarts, 2010; Moors & De Houwer, 2006). If it was the case that participants were attending more to the digit rehearsal aspect of the photo-description task, then this may have diminished the encoding of the target gestures performed by the actor. Furthermore, participants' focus on the digit rehearsal task may have detracted from the social or interactive aspects of the photo-description task.

An important difference to consider between these two cover stories is the focus on others (Chapter Three) and the self (Chapter Four). This is because increased self-focus has been implicated to disrupt processes (Dijksterhuis & Bargh, 2001) and behaviours (Wulf, McNevin, & Shea, 2001) held to be automatic. Furthermore, individuals who perceive and process information with a greater self-focus show less of a tendency to express mimicry as compared to those with a more other-focus orientation (van Baaren, Maddux, Chartrand, Bouter, & van Knippenberg, 2003b). Thus, the task instructions used to introduce the digit rehearsal task may have shifted participants' attentional focus to their (self) ability to perform two tasks at once, rather than the more interactive component of receiving and exchanging information with an (other) individual. As a result, the mimicry effect may have been reduced. Moreover, the finding that mimicry was not demonstrated in the no load condition in Experiment 5, when the digit rehearsal task was simply a component of the study that participants were told about but did not actually perform, would suggest that the mimicry effect is relatively sensitive to subtle changes in the context of the task in which mimicry is measured. Of course, while the null findings may reflect one or more of the above factors, the fact remains that the mimicry effect appears to be more unreliable than anticipated. I will return to this point in the final chapter.

To date, very little research has attempted to assess whether mimicry is automatic by addressing the four criteria for automaticity separately. It is possible that assessing the automatic criteria of mimicry cannot be approached in the same way as imitation effects (e.g., Brass et al., 2005; van Leeuwen et al., 2009) or automatic stereotype priming effects (e.g., Bargh & Tota, 1988; Gilbert & Hixon, 1991). The previous demonstration that the tendency to mimic is moderated by relatively subtle contextual cues within an interaction (Lakin et al., 2008; Martin et al., 2010; Yabar et al., 2006) is in line with the indication of the present results that mimicry appears to be very sensitive to the information given about the experiment task (e.g., the photo-description task). Thus, directly assessing the automatic characteristics of mimicry needs to be incorporated into the task in a way that maintains participants' attentional focus on the actor and the communicative exchange aspect of the task. The mimicry literature has consistently used cover stories for experiments examining mimicry behaviour, often including very socially interactive concepts (e.g., Ashton-James & Chartrand, 2009; Karremans & Verwijmeren, 2008; Lakin & Chartrand, 2003; Cheng & Chartrand, 2003; van Swol, 2003). Therefore, to examine the efficiency of mimicry behaviour future research may need to use cognitively demanding

situations that allow for the participants' direction of attentional focus to remain on the actor or individual performing the target gestures. Importantly, effects that may require a high degree of attentional focus, in that the direction of attention is key, may not necessarily require a great amount or quantity of attentional resources (Moors & De Houwer, 2006). Therefore, if attentional focus appears to be an important aspect for nonconscious mimicry to occur, the effect could theoretically still be considered efficient if it is demonstrated that mimicking consumes a minimal amount of attentional resources.

The current chapter does not fully ascertain the efficient or inefficient nature of mimicry behaviour, as mimicry was not demonstrated. However, examining two of the major changes made to the mimicry paradigm, duration of exposure to the target gesture and introduced attentional demands, did not fully explain the unexpected results in Chapter Four. Rather, the findings from Experiments 4 and 5 seem to arise from the procedural changes made to the mimicry paradigm, particularly the explanation of the photo-description task given to participants. These results suggest that the mimicry effect may be relatively sensitive to task instructions and cues, and provide further insight to the way in which to approach assessing the automaticity criteria of nonconscious mimicry. It may be necessary to examine the automatic nature of mimicry by incorporating this assessment more seamlessly into the photo-description task. Specifically, future experiments may need to return to the cover story which leads participants to believe that the photo-description task is examining successful communication to others via video, and provide information that shifts attentional focus on to the actor.

Therefore, Chapter Five aims to directly assess the awareness criterion of mimicry's automaticity, which provides an excellent opportunity to integrate the assessment of automatic features of the effect in a way that maintains participant's attentional focus on the actor. In addition, within the nonconscious mimicry literature the mimicry effect has been defined as automatic on the basis of the awareness criterion alone (Chartrand & van Baaren, 2009). Directly assessing the role of awareness in mimicry behaviour presents the best progression to continue the feature-based approach in assessing the automatic nature of nonconscious mimicry.

Chapter Five:

The Role of Awareness in Mimicry as an Automatic Behaviour

5.1 Introduction

The results from Chapter Four were not able to clarify the (in)efficient nature of nonconscious mimicry. However, the findings did suggest that contextual cues and attentional focus on the actor performing that target gestures may be important in reliably demonstrating the mimicry effect. Considering the previous chapter's findings, the standard mimicry paradigm employed in Experiment 2 was returned to in order to reliably demonstrate nonconscious mimicry. In addition, the current chapter aims to continue a feature-based approach (Moors & De Houwer, 2006; 2007), whereby the automaticity criteria are examined individually, and in turn, within the mimicry effect. Given that the mimicry effect has been defined as being automatic on the basis of the awareness criterion alone (Chartrand & van Baaren, 2009), and that assessing awareness can be cleanly integrated into the mimicry paradigm in a way that maintains participants attentional focus on the actor, examining awareness provides an excellent continuation of a more detailed investigation of the automaticity of nonconscious mimicry.

5.1.2 Awareness in Mimicry Behaviour

Research has demonstrated that the awareness of mimicry's occurrence does not appear to disrupt the positive social consequences often found as a result of mimicking in an interaction. Stel, Blascovich, McCall, Mastop, van Baaren and Vonk (2009) found that explicitly instructing participants to mimic an actor resulted in increased instances of prosocial behaviour (e.g., donating more money to charity), similar to the increased prosocial behaviour found when participants are unaware of mimicry taking place in an interaction (van Baaren, Holland, Kawakami, & van Knippenberg, 2004b). However, it remains unclear how awareness influences the actual expression of mimicry behaviour.

The concept of awareness has previously been considered in research on the expression of nonconscious mimicry; however, as discussed in Chapter One, this has typically been

assessed via the use of retrospective self-reports of awareness (Bargh & Chartrand, 2000; Chartrand & Bargh, 1999). Specifically, after a task (e.g., a photo-description task) in which a target gesture has been presented to participants and their mimicry behaviour was measured, participants are typically asked to report whether they noticed anything unusual during the experiment. This is often assessed using a funnelled debrief in which participants are prompted to report awareness of unusual behaviour from the confederate and suspicions about the true aim of the experiment (Chartrand & Bargh, 1999). Based on participants' general inability to report awareness of mimicry's occurrence, the effect has been proposed to be automatic, occurring without conscious awareness (e.g., Bailenson & Yee, 2005; Dalton, Chartrand, & Finkel, 2010; Lakin & Chartrand, 2003; van Baaren, Fockenberg, Holland, Janssen, & van Knippenberg, 2006; van Baaren, Janssen, Chartrand, & Dijksterhuis, 2009). This type of self-report measure is the most frequently used method to establish nonconscious mimicry occurring without awareness within the literature (Ashton-James & Chartrand, 2009; Bailenson & Yee, 2005; Cheng & Chartrand, 2003; Finkel et al., study 5, 2006; Johnston, 2002; Lakin & Chartrand, 2003; Lakin, Chartrand, & Arkin, 2008; van Baaren, Maddux, Chartrand, Bouter, & van Knippenberg, study 3, 2003b; van Baaren, Horgan, Chartrand, & Dijkmans, study 1, 2004a; Vrijssen, Lange, Dotsch, Wigboldus, & Rinck, 2009; Vrijssen, Lange, Becker, & Rinck, 2010; Yabar, Johnston, Miles, & Peace, 2006) and has also been used within this thesis (see Experiments 1-5).

This retrospective measure has provided a valuable step toward demonstrating that mimicry occurs without awareness. However, there are three main questions regarding the role of awareness in mimicry behaviour that the retrospective measure may not be able to address: Can self-report measures alone provide information about processes suggested to occur unconsciously? Would objective measures, such as observable behaviour, verify the previous results using subjective measures suggesting that mimicry occurs without awareness? Are self-report measures sensitive enough to gauge the discreet manner with which nonconscious mimicry may operate without awareness?

There is a history of scepticism regarding the ability of self-report measures to provide information about the underlying process of the effect being examined (e.g., Ericsson & Simon, 1980; Nisbett & Wilson, 1977; Wilson & Dunn, 2004). Although there is some debate as to whether behaviour initiated without conscious awareness is, or is not, accessible to introspection (Jack & Shallice, 2001), self-report measures make the

assumption that individuals are aware, and able to report their conscious experiences (Schooler, 2002). In mimicry research, the retrospective measure assesses participants' knowledge of the mimicry manipulation and their subsequent behaviour that is accessible to introspection. However, these introspective judgements can be misleading. Factors such as cognitive resource capacity, affective state and the way that individuals are asked to report their experience can bias or alter an individual's evaluation of an event (Schooler, 2002). These issues of the validity of self-report measures mainly influence the introspection directed at experiences of which an individual was consciously aware. The mimicry literature generally reports a relatively low percentage of participants who were consciously aware of target gestures (Bargh & Chartrand, 2000), thus these issues of validity would be expected to affect a small portion of the tested sample. Overall, this finding appears to be consistent with the hypothesis that participants are not consciously aware of the gestures triggering the effect or the effect's occurrence. However, certain considerations are needed in the use of self-report measures to assess the processes that are proposed to occur unconsciously.

Reports based on introspection tend to be relatively insensitive when directed at subtle experiences that occur outside of conscious awareness (Schooler, 2002), suggesting that self-report measures may not have the ability to assess outcomes that are automatic in nature (De Houwer, 2006). For instance, subliminal priming of words can alter perceivable behaviour; such as priming the words 'thirst' and 'dry' can cause increased beverage intake (Strahan, Spencer, & Zanna, 2002). However, individuals are unable to introspectively report experiencing increased thirst. Similar findings of dissociation between implicit measures of prejudicial attitudes and self-report measures have been well documented using the Implicit Association Test (IAT) (Woodside, 2006). Notably, the above examples use both subjective self-report measures as well as more objective measures, such as observable consumption behaviour (Strahan et al., 2002), to make inferences about the unconscious nature of a given effect. This use of objective measures to verify subjective reports is heavily advocated when drawing conclusions about underlying processes using self-report measures (e.g., Corallo, Sackur, Dehaene, & Sigman, 2008; Jack & Roepstorff, 2003). Within the mimicry literature, the self-report awareness measure has primarily been used as a means to identify and remove from the behavioural analysis individuals who report awareness of the fact that mimicry is being examined (Bailenson & Yee, 2005; Bargh & Chartrand, 2000; Chartrand & Bargh, 1999;

Cheng & Chartrand 2003; Gueguen & Martin, 2009; Lakin & Chartrand, 2003; Lakin, Chartrand, & Arts, 2008; Sanchez-Burks, Bartel, & Blount, 2009; Tanner, Ferraro, Chartrand, Bettman, & van Baaren, 2008; van Baaren et al., 2003b; Yabar et al., 2006). Thus, no comparison of subjective reports of awareness and the influence that awareness has on mimicry behaviour has been implemented so as to better understand the role of awareness.

In reviews, Chartrand (2005) and van Baaren and colleagues (2009) speculate that when mimicry behaviour does become conscious, individuals should show the tendency to inhibit or control their behaviour. Although this remains empirically untested, promoting awareness of target behaviour or participants' mimicry behaviour itself would be expected to reduce or remove the mimicry effect. This anticipated change in mimicry behaviour due to awareness would provide an objective measure that would validate the self-report measures currently employed. Therefore, this chapter aims to better specify the role of awareness on nonconscious mimicry by attempting to manipulate awareness, and by measuring the subsequent influence on mimicry behaviour, as well as by subjectively measuring awareness. This approach also has the potential to provide further insight into the last question raised regarding the retrospective measure's ability to gauge participant awareness, namely, the sensitivity of the retrospective measure.

Thus far, awareness has been discussed in relatively general terms. However, a more refined definition of awareness has been put forward; in particular, that there are at least three different ways with which an automatic process may operate without awareness (Bargh, 1994; Moores & De Houwer, 2007). An individual may be unaware of: a) the stimuli that induces the automatic process (e.g., target gestures), b) the output of the automatic process (e.g., actual mimicry behaviour expressed), or c) the automatic process itself (e.g., the influence the target gestures have on the observer's behaviour) (Moores & De Houwer, 2007). The questions typically included in the retrospective measure of awareness may not be able to distinguish between these three possibilities. Participants' awareness of target gestures, point (a) has been examined by indirectly probing participants as to whether they noticed anything unusual during the study. Awareness of the automatic process itself, point (c) has been assessed within the retrospective measure as an exclusion criterion prior to analysing behaviour, as discussed above. The typical retrospective measure does not, however, address point (b), awareness of the output of the automatic process (e.g., actual

mimicry behaviour expressed). In the present chapter, the manipulation of awareness aimed to serve as a more direct test of point (a). In addition, point (b), participants' awareness of their own mimicry behaviour, was further explored. Namely, the retrospective measure of awareness was extended to examine the extent to which individuals were aware of their own expression of mimicry, when it occurs. Specifically, by asking participants to report the number of times that they believed that they expressed face-rubbing behaviour, this could be compared to actual face-rubbing behaviour expressed.

Directly manipulating awareness, and measuring its subsequent influence on mimicry behaviour, has the potential to address the discussed issues regarding the retrospective measure of awareness. Following Chartrand (2005) and van Baaren et al.'s (2009) predictions, it is expected that drawing an individual's attention or awareness to the actor's behaviour in the stimulus video would lead to decreased levels of mimicry. This experiment is the first study to date, to my knowledge, which directly assesses the influence of awareness of target behaviour on the tendency to mimic. If these predictions were supported this would demonstrate a more direct influence of awareness on mimicry behaviour and, as such, would provide more compelling evidence that operating without awareness is necessary to demonstrate mimicry. In addition, the current study aimed to extend the present understanding of an individual's awareness of expressing mimicry by examining the degree to which participants were aware of changes in their own behaviour when mimicry occurs. If participants are unaware of their own mimicry behaviour, a dissociation between reported and actual behaviour would be expected.

5.2 Experiment 6

5.2.1 Overview

The aim of Experiment 6 was to investigate whether manipulating awareness of the actor's behaviour influences participants' mimicry behaviour. To examine this, an exact replication of the mimicry paradigm employed in Experiment 2 was used (with the exception of the baseline measure), in which participants were exposed to either no gestures or face-rubbing. However, to manipulate awareness, some of the participants exposed to the face-rubbing gesture were made aware of the actor's behaviour indirectly by being given the information that the person in the video was "fidgety" prior to the

photo-description task. In addition, the traditional awareness check was extended, and participants were asked to report the number of times that they believed that they expressed face-rubbing behaviour during the experiment to later compare against actual behaviour expressed.

It was predicted that participants who were shown the target gesture and given no information about the actor's behaviour would express a higher rate of face-rubbing behaviour as compared to those shown no gestures and given no information, replicating the mimicry effect. In line with the hypothesis that awareness should eliminate mimicry behaviour (Chartrand, 2005; van Baaren et al., 2009), information given about the actor's behaviour was expected to decrease participants' mimicry behaviour. Specifically, when exposed to the target gesture, participants receiving the fidgeting information were expected to show a decrease in face-rubbing behaviour, compared to participants given no information about the actor. Thus, participants given the fidgeting information were expected to express face-rubbing behaviour at, or below, the level of face-rubbing expressed in the no gesture (control) condition. It was also predicted that participants who were told that the actor was fidgety would report the highest levels of awareness of the actor's behaviour, compared to those given no information about the actor's behaviour and those shown no gestures and given no information. Finally, it was predicted that individuals would not be able to accurately self-report their own expression of the target gesture, significantly underestimating the frequency that they expressed face-rubbing behaviour when mimicry occurs, as it is proposed to largely operate unconsciously (Chartrand & van Baaren, 2009).

5.2.2 Method

5.2.2.1 Participants and Design

Seventy-four undergraduate and postgraduate students (62 females, 12 males; age $M = 25.62$, $SD = 10.69$) were randomly allocated to a 3 (condition: no gestures-no information vs. gestures-no information vs. gestures-fidget information) between-participants design. Participants received partial course credit or £4 as payment for participation.

5.2.2.2 Procedure

The same procedure and stimulus videos from Experiment 2 were employed with the following changes. All participants were randomly assigned to one of the three conditions. Participants assigned to the no gestures-no information condition were shown the actor performing no gestures and received no information about the actor's behaviour. Participants in the gesture-no information condition were shown the stimulus video containing face-rubbing and were given no additional information about the actor's behaviour. Participants in the gesture-fidgeting information condition were shown the stimulus video containing face-rubbing and were told the recorded participant was quite fidgety. Following the baseline measure employed in Experiments 4 and 5, all participants completed the photo-description task in which the stimulus video was played twice, were asked to describe two photographs, complete the dependent measures outlined below before being debriefed and thanked for their participation.

5.2.2.3 Dependent Measures

Measures of affect and participant behaviour were taken, all of which were identical to those previously used in Experiments 2-5. Three new manipulation check measures regarding the awareness manipulation were included: the way in which the actor was perceived, self-reported behaviour and an extended awareness check.

Perception of the Actor

Following the completion of the photo-description task, all participants were asked to rate how much they liked the actor on a seven point scale. Two additional items were included which asked participants to rate the two statements "Did you find that the actor seemed distracted or restless?" and "I was aware the actor was fidgeting" on a seven point scale. These two items acted as an explicit measure to assess the way that participants perceived and were aware of the actor's behaviour.

Self-Reported Behaviour

Participants were then asked to complete a gesture questionnaire to determine their

awareness of their own behaviour. Participants were asked to report the number of times that they thought that they performed various common gestures, including face-rubbing behaviour, specifically during the photo-description task (see Appendix 7).

Awareness Check

Finally, the same funnelled debrief questionnaire as was used previously was employed to determine participants' awareness of the actor's behaviour and their suspicions of the true aim of the experiment. However, one item was added, which asked participants to rate on a seven point scale the degree to which they agreed with the statement, "I tried not to fidget" (see Appendix 8). This item acted as an explicit measure to assess participants' intention to control their own behaviour.

5.2.3 Results

Awareness Check

Mimicry behaviour data was treated in the same way as in Experiments 2-5. One participant was excluded from the behaviour analyses for paying insufficient attention to the video during the experiment.¹² The remaining 73 participants' responses to the traditional retrospective awareness check were analysed to confirm that any mimicry behaviour observed occurred without participants' awareness of the effect.

In response to the question that asked participants if they had noticed anything unusual, 6.8% (5 out of 73; all in the gesture-fidget information condition) reported the actor as being fidgety or distracted. A further 5.4% (4 out of 73; all in the gesture-no information condition) of participants explicitly stated that the gesture 'face-rubbing' was unusual. Within these nine individuals who reported awareness of the actor's fidgeting or face-rubbing behaviour, three guessed the main aim of the study (2 in gesture-no information, and 1 in gesture-fidget information conditions). Notably, an additional six participants who did not report noticing anything unusual about the actor's behaviour also guessed the main aim of the study. Thus, a total of nine participants, or 12.3% of the tested sample, reported that they believed the study was examining mimicry behaviour (1 in no gesture-no

¹² The participant was identified during video coding as closing their eyes for over half (more than 3.5 minutes) of the video stimulus presentation.

information,¹³ 3 in gesture-no information and 5 in gesture-fidget information conditions), and were removed from all subsequent analyses.

Although those given the fidgeting information were expected to report relatively high levels of awareness of the actor's gesturing behaviour, those who reported awareness of the target gesture were all in the gesture-no information condition. This will be further discussed at the end of the chapter in relation to the additional awareness measures reported below.

5.2.3.1 Behavioural Mimicry

In order to check the reliability of behaviour coded as face-rubbing, 30% of participant video-recorded sessions were double-coded by a second coder blind to condition and the hypotheses of the experiment. The inter-rater reliability for participants' face-rubbing behaviour was high, $r = .84$, $p < .001$, $\alpha = 0.91$. Exploratory analysis revealed violations of normal distribution in the data; as a result, 2 participants were removed as outliers 2.5 standard deviations above the mean rate of face-rubbing behaviour (Upton & Cook, 2008; van Baaren et al., 2006) and the behaviour data were Log10 transformed (Field, 2005) to correct data distribution. Exploratory analysis also found, overall, that the pre-experiment baseline measure of participant face-rubbing behaviour ($M = 1.01$, $SD = 1.49$) was relatively comparable to face-rubbing behaviour expressed during the photo-description task ($M = 0.56$, $SD = 0.59$), and that this was consistent across condition. Thus, the baseline measure was included in the behavioural analysis as a covariate. To reiterate, a total of 12 participants were removed from the analyses (one for paying insufficient attention, nine for guessing the main aim of the study and two as statistical outliers), leaving 62 participants balanced across the three conditions in all further analyses.

A 3 (condition: no gestures-no information vs. gestures-no information vs. gestures-fidgeting information) between-participants ANCOVA was run on participants' frequency per minute face-rubbing behaviour. The pre-experiment baseline measure of face-rubbing expressed by participants was included as a covariate. The baseline measure was significantly related to participants' face-rubbing behaviour during the experiment period,

¹³ This participant reported that they had previously taken part in a similar photo-description mimicry study.

$F(1, 65) = 4.34, p = .04, f^2 = 0.27$. After accounting for baseline face-rubbing behaviour there was a main effect of condition, $F(2, 58) = 3.19, p = .05, f^2 = 0.33$ (see Figure 5.1).

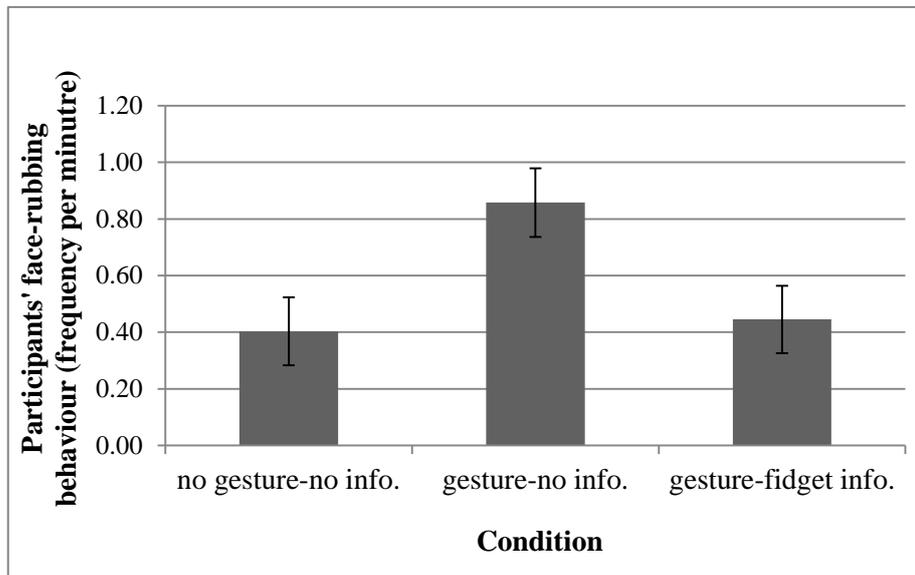


Figure 5.1. Marginal means for face-rubbing behaviour as a function of condition +/- 1 SEM (figure error bars are based on larger error estimates than those used for Log10 transformed analysis).

Planned contrasts (repeated) revealed that mimicry was demonstrated as levels of face-rubbing were significantly higher in the gesture-no information in comparison to the no gesture-no information condition, $p = .03$. There was also a significant difference in face-rubbing behaviour expressed in the gesture-no information and gesture-fidgeting information conditions, $p = .04$, suggesting that face-rubbing was significantly reduced by the presence of the information. The finding that face-rubbing behaviour in the gesture-fidgeting information condition was expressed at similar levels to the no gesture (control) condition and was significantly lower than the face-rubbing behaviour expressed in the gesture-no information condition suggests that mimicry was eliminated when participants were informed the actor was fidgety prior to exposure to the target gestures.

5.2.3.2 Perception of the Actor

Awareness

Ratings on the two items measuring awareness of the actor's behaviour, (how restless or distracted the actor appeared and how aware participants were of the actor's fidgeting), were averaged to create an awareness index score ($\alpha = 0.91$). A 3 (condition: no gesture-no

information vs. gesture-no information vs. gesture-fidget information) between-participant ANOVA was run on the awareness index score. There was a main effect of condition, $F(2, 59) = 56.23, p < .001, f^2 = 0.81$. In line with the prediction made, planned contrasts (repeated) revealed that those who were told that the actor was fidgety rated being more aware of the actor's behaviour ($M = 5.93, SD = 1.01$) as compared to participants given no information ($M = 4.95, SD = 1.56, p = .01$), who rated being more aware of the actor's behaviour as compared to participants in the no gesture-no information condition ($M = 2.12, SD = 0.97, p < .001$).

Liking

Participants' ratings of how much they liked the actor showed that the information given about the actor's behaviour and gesture seen did not affect liking ratings, $F(2, 59) = 1.25, p = .29, f^2 = 0.16$. The mean rating of liking ($M = 4.42, SD = 1.17$) was significantly higher than the mid-point of the scale (4) where higher scores indicated more liking, $t(61) = 2.83, p = .01, d = 0.62$. This suggests that participants were generally positive towards the actor in all three conditions.

5.2.3.3 Self-Reported Versus Actual Behaviour

The self-reported number of times that participants performed the three gestures related to face-rubbing behaviour; *resting chin in hand*, *touch your face*, and *scratch your nose*, were taken to measure participants' awareness of their own face-rubbing behaviour. Importantly, these three gestures were within the face-rubbing behaviour area used in the coding scheme when coding participants' actual behaviour. The reported number of times these gestures were performed was summed to give an overall self-reported face-rubbing frequency score for each participant. This self-reported score was compared against the total number of times (as opposed to the frequency per minute score used in the previous analyses) that participants expressed face-rubbing behaviour during the video period and the photo-description period combined.

A 2 (face-rubbing: self-reported vs. actual behaviour) x 3 (condition: no gesture-no information vs. gesture-no information vs. gesture-fidget information) mixed ANOVA was run, with the face-rubbing factor as the within-participant factor. Analysis showed a

significant main effect of the face-rubbing factor, $F(1, 59) = 7.87, p = .01, f^2 = 0.37$. Overall, participants significantly underestimated the frequency of their expressed face-rubbing when they reported touching their face ($M = 3.77, SD = 5.08$), compared to the actual expressed frequency of the behaviour ($M = 6.24, SD = 6.48$). There was a significant main effect of condition, $F(2, 59) = 3.09, p = .05, f^2 = 0.32$. However, pairwise comparisons (Bonferroni corrected) showed that participants overall face-rubbing scores (self-reported and actual behaviour) were not different between the no gesture-no information ($M = 3.95, SD = 4.42$) and the gesture-no information ($M = 7.03, SD = 4.41$) conditions, $p = .09$. The gesture-fidget information ($M = 4.14, SD = 4.42$) was also not significantly different from the no gesture-no information, $p = .99$, or from the gesture-no information, $p = .12$ conditions. Although the interaction between the face-rubbing factor and condition was marginal, $F(2, 59) = 2.68, p = .08, f^2 = 0.30$ (see Figure 5.2), due to the a priori hypothesis that participants would significantly underestimate the frequency that they expressed face-rubbing behaviour when *mimicry* occurred (i.e. in the gesture-no information condition) this interaction was decomposed.



Figure 5.2. Mean self-reported and expressed face-rubbing behaviour as a function of condition +/- 1 SEM.

The difference in self-reported and expressed face-rubbing behaviour was examined within the three conditions individually (using a corrected alpha level of .016). Within the no gesture-no information condition, there was no significant difference between the reported and expressed frequency of face-rubbing behaviour, $t(20) = 0.12, p = .91, d = 0.03$.

However, in the gesture-no information condition in which mimicry was demonstrated, there was a significant difference between the self-reported and expressed face-rubbing measures, $t(19) = 3.07, p = .006, d = 0.69$. In the gesture-fidget information condition there was no significant difference between the self-reported and expressed face-rubbing measures, $t(20) = 1.53, p = .14, d = 0.37$. These results support the prediction that when mimicry occurred, particularly in the gesture-no information condition, participants were largely unaware of expressing the target gesture themselves and were not aware of their own mimicry of the actor's behaviour.

Intention to Control Behaviour

A 3 (condition: no gesture-no information vs. gesture-no information vs. gesture-fidget information) between-participants ANOVA was run on the measure of intention to inhibit fidgeting item. Contrary to predictions, there was no significant difference between the conditions on participants' ratings of their intention to inhibit their own fidgeting behaviour ($M = 4.61, SD = 1.86$), $F < 1, p = .84, f^2 = 0.08$. Given that there was no difference in self-reported intention to inhibit fidgeting behaviour between the three conditions, this factor was examined as a predictor of participants' expressed face-rubbing behaviour collapsed across conditions. Simple regression analysis indicated that participants' ratings on the intention to inhibit fidgeting behaviour was not a significant predictor of the face-rubbing behaviour that was expressed during the photo-description task, $\beta = -.07, p = .61$, accounting for 0.4% of the variation in face-rubbing behaviour expressed. Thus, the gesture seen and information given to participants did not seemingly influence their conscious intention to inhibit their behaviour, and overall this item was a weak predictor of actual behaviour expressed

5.2.3.4 SAM Measure

A 2 (time: pre-SAM vs. post-SAM) x 3 (condition: no gesture-no information vs. gesture-no information vs. gesture-fidget information) mixed ANOVA was run, with time as the within-participant factor. This analysis was conducted on each SAM item separately. Analysis indicated that ratings on the SAM pleasure scale (see Table 5.1), showed no significant change over time, $F < 1, p = .42, f^2 = 0.10$, were not significantly different between the conditions, $F < 1, p = .73, f^2 = 0.11$, and that there was no significant

interaction between time and condition, $F(2, 59) = 1.67, p = .20, f^2 = 0.21$. Furthermore, at both time points pleasure ratings were significantly below the midpoint of the scale (3), pre-experiment $p < .001, d = 1.56$, and post-experiment $p < .001, d = 1.48$. This suggests that all participants were relatively happy throughout the study, regardless of condition.

Ratings on the SAM arousal scale (see Table 5.1) were not significantly different between the conditions, $F(2, 59) = 1.30, p = .28, f^2 = 0.24$, and there was no significant interaction between time and condition, $F(2, 59) = 2.27, p = .11, f^2 = 0.20$. However, ratings showed a significant change over time, $F(1, 59) = 11.11, p = .001, f^2 = 0.36$. Participants experienced an increase in feelings of nervousness after the photo-description task ($M = 3.00, SD = 0.99$), relative to ratings at the start of the experiment ($M = 2.61, SD = 0.75$). Ratings were significantly below the midpoint (3) of the scale pre-experiment, $t(61) = -4.04, p < .001, d = 0.57$, however, rating post-experiment were not significantly different to the midpoint of the scale, $t(61) = 0.00, p = 1.00, d = 0.10$. Nevertheless, this increase in arousal did not indicate that participants were exceedingly nervous.¹⁴

Table 5.1

Mean Ratings on the SAM Pleasure and Arousal Scales as a Function of Time and Condition

	No gesture- no information	Gesture- no information	Gesture- fidget information
<i>SAM Pleasure</i>			
Pre-measure	2.19 (0.75)	1.90 (0.55)	1.95 (0.67)
Post-measure	2.05 (0.67)	2.05 (0.39)	2.14 (0.66)
<i>SAM Arousal</i>			
Pre-measure	2.81 (1.03)	2.55 (0.51)	2.48 (0.75)
Post-measure	3.00 (1.05)	3.30 (0.87)	2.71 (0.99)

5.3 Discussion

The results from Experiment 6 demonstrated that the relatively subtle manipulation of awareness showed a direct influence on mimicry behaviour. The findings suggest that informing participants of the general fidgeting behaviour of the actor was sufficient to

¹⁴ The findings on the SAM pleasure and arousal measures replicate those found in Experiments 2-5 and, thus, are not discussed further.

eliminate mimicry of the face-rubbing target gesture. Moreover, an apparent dissociation between the subjective self-report and objective measure of participant behaviour emerged when mimicry was demonstrated. In adopting the feature-based approach (Moores & De Houwer, 2007); Experiment 6 intended to more rigorously examine the awareness criterion that has defined mimicry as an automatic behaviour. Although previous subjective evidence from retrospective measures suggests that mimicry occurs without the mimicker's awareness (Bargh & Chartrand, 2000), Experiment 6 provided the first experimental evidence, to my knowledge, that operating without awareness appears to be essential in demonstrating this effect. These results are in line with the speculation put forward by Chartrand (2005) and van Baaren et al. (2009).

There are three different ways with which an automatic process may operate without awareness, namely: unawareness of a) the stimuli that induces the automatic process, b) the output of the automatic process, or c) the automatic process itself (Moores & De Houwer, 2007). The current results most directly address the first point of operating without awareness, by assessing changes in participants' behaviour in relation to the information given to them about the actor's behaviour (e.g., the behaviour inducing mimicry). Additionally, the subjective measures of awareness collected, both participants' awareness of the actor's behaviour and of their own behaviour, provide further insight to these three discrete areas of awareness. These measures will be discussed in relation to the more objective measure of participants' behaviour within the three criteria of awareness outlined by Moores and De Houwer (2007).

Awareness of Target Gestures and Mimicry Behaviour

The awareness manipulation employed in the present experiment aimed to directly address point (a) above. Results indicated that when participants were given no prior information about the actor's behaviour, mimicry was demonstrated relative to the no gesture (control) condition. This replicated the findings from Experiment 2. Moreover, those receiving the fidgeting information showed significantly less face-rubbing behaviour, compared to those exposed to the target gesture and no information, reduced to similar levels as was exhibited in the no gesture no information condition. Thus, the participants who were told that the actor was fidgety (to heighten awareness of the target gestures) did not express statistically significant levels of mimicry behaviour. Notably, the participants in the fidgeting

information condition were not directly made aware of the target gesture face-rubbing, but were simply made aware of the actor's more general fidgeting behaviour. The finding that mimicry was eliminated due to this manipulation suggests that the mimicry effect shows a relatively high degree of sensitivity to the perceiver's awareness of the stimuli that triggers the effect.

If this manipulation of awareness (e.g., telling participants that the actor was fidgety) was causing participants to become consciously aware of the target gestures, then this should have been reflected in the self-report measures. The two self-report measures employed were: the traditional retrospective awareness measure (e.g., indirectly probing for awareness of the actor's behaviour) and the two additional awareness check items (e.g., directly asking participants about the actor's behaviour). Responses to the traditional awareness measure items did not; however, appear to reflect the awareness manipulation of making the actor's behaviour more noticeable in the fidgeting information condition. Although a small percentage of participants did state that the actor was fidgety, none of the participants in the gesture-fidget information condition explicitly stated that the actor's face-rubbing behaviour was unusual. These findings potentially indicate that the awareness manipulation employed may not have made participants consciously aware of the target gestures per se but simply more broadly aware of the actor's gesturing. One could argue that eliminating mimicry behaviour in the fidgeting information condition may have been due to the way in which fidgeting behaviour is perceived. Fidgeting could potentially be viewed as a negative quality, thus making the actor a less desirable person to be mimicked (Johnston, 2002; Yabar et al., 2006). However, the ratings on the likability of the actor were relatively high and did not vary between the three conditions, suggesting that the likeability of the actor was not driving the reduction of mimicry.

The wording of the indirect traditional measure used to gauge awareness of the target gesture may provide an alternative explanation. Participants in the fidget information condition were, in a sense, forewarned about the actor's fidgeting behaviour. Thus, the actor's behaviour would be unlikely to be perceived as 'unusual'. Indeed, the 5.4% of participants who explicitly reported the actor's 'face-rubbing' as unusual were all in the gesture-no information condition.¹⁵ This suggests that this item in the traditional awareness

¹⁵ This was relatively similar to the 4.4% cited in Experiment 2 which employed a comparable manipulation.

check may not have been sensitive enough to indicate awareness of the target gestures in relation to the manipulation employed in Experiment 6. The potential insensitivity of this item was supported by the surprising finding that a large portion of the participants who guessed the main aim of the study did not report anything unusual about the actor's behaviour.

However, responses to the two new, more direct, awareness items indicated that participants in the fidget information condition did rate themselves as being more aware of the actor appearing *distracted*, *restless* and *fidgety*, compared to those given no information prior to being exposed to the actor's face-rubbing behaviour. The responses to these additional direct questions seemed to more accurately reflect the awareness manipulation employed and the behavioural data at hand. At a broader level, the traditional funnelled debrief measure may benefit from the inclusion of these more direct awareness items in future research. More specifically, in Experiment 6, the self-report and behaviour measures indicate that for participants exposed to face-rubbing behaviour a higher level of reported awareness was accompanied by lower levels of mimicry behaviour. Importantly, the comparison of participants' behavioural tendencies for those reporting higher and lower levels of awareness of the actor's behaviour, provided a somewhat more objective measure to validate interpretations about underlying processes based on self-report measures (Jack & Roepstorff, 2003), as opposed to using the awareness check to remove participants from analysis (e.g., Chartrand & Bargh, 1999; Gueguen & Martin, 2009; Sanchez-Burks et al., 2009; van Baaren et al., 2003b). Notably, a mediation analysis was considered in order to demonstrate that this difference in awareness between the two face-rubbing conditions had a more causal role in participants' expression of face-rubbing behaviour. However, the data at hand violated two key assumptions of the mediation analysis. Firstly, the information given to participants about the actor (i.e., "fidgety") was not independent from the measure included in the awareness index (i.e., participants rating of the fidgetiness of the actor) that would have been employed as the mediating variable (MacKinnon, Fairchild & Fritz, 2007). Secondly, the measure taken as the mediator should be taken before or during the time period in which the outcome variable (i.e. participants face-rubbing behaviour) is measured to avoid possible reverse causal effects (Kenny, 2011), which was not the case in the present study. Nonetheless, the evidence from Experiment 6 appears to partially substantiate previous claims provided by subjective measures suggesting that mimicry primarily occurs without awareness.

One limitation that must be considered, however, is that the assertion that *nonconscious* mimicry was demonstrated in the gesture-no information condition was still reliant on self-report measures of participant awareness, the issues of which were discussed in the introduction of this chapter. Future research could address this limitation by employing a forced choice task in which participants complete a number of trials where they are shown two brief video clips of the actor, one which was taken directly from the stimulus video shown to them and another of the same actor describing the photos while performing different behaviours. If participants were aware of the actor's behaviour during the photo-description task, then they would be expected to choose significantly more video clips taken directly from the stimulus video as compared to those never shown to them with the actor performing different behaviours. However, with this limitation in mind, these results are consistent with one way that mimicry may occur without awareness (Moore & De Houwer, 2007), specifically, when individuals are unaware of the target gestures inducing mimicry behaviour. Similarly, self-report measures also indicated that individuals seem to be unaware of the changes in their own behaviour when mimicry occurred.

Participants' Awareness of Their Own Mimicry Behaviour

The second way that a process may occur without awareness, point (b), is unawareness of the output of the automatic process (Moore & De Houwer, 2007). This suggests that when target gestures are perceived, individuals should be largely unaware of their own mimicry of those target gestures. The self-report items that asked participants about the gestures they expressed during the experiment (their frequency of the gestures expressed and intention to inhibit) address this element of awareness. Similar to results examining subliminal priming effects (Strahan et al., 2002) and implicit attitudes (Woodside, 2006), evidence from Experiment 6 indicated a dissociation between self-reported behaviour and actual behaviour expressed.

Results from the self-reported frequency of face-rubbing suggested that all participants, regardless of condition, reported relatively similar estimates of face-rubbing behaviour. Interestingly, participants who were exposed to no gestures were fairly accurate in their self-reported frequency, as were participants given the fidgeting information about the actor, showing no difference to the face-rubbing behaviour that they actually expressed.

However, participants in the gesture-no information condition significantly underestimated the number of times that they expressed face-rubbing behaviour. Relative to self-reported behaviour in the no gesture condition, it is possible that participants in the gesture-no information condition were aware of their general or natural level of face-rubbing. However, they were apparently not aware of the increase in their behaviour due to perception of the target gestures. The evidence obtained suggests that when mimicry occurred participants were unable to report and, thus, were likely unaware of their own mimicry behaviour.

Similarly, there was no relationship between reported intention to inhibit behaviour and actual behaviour that was expressed. Participants reported no difference in subjectively experiencing the intention to inhibit their own 'fidgeting' behaviour between the three conditions. Being made aware of the actor's behaviour resulted in eliminating mimicry behaviour, yet participants in the fidgeting information condition did not report higher levels of the conscious intention to inhibit their behaviour relative to those in the no information conditions. Although this question did not directly ask participants about inhibiting their face-rubbing behaviour, it does suggest that the differences in participant behaviour between the three conditions was not driven by participants consciously controlling or inhibiting general fidgeting behaviour.

The results from the two self-report items, frequency of face-rubbing and intention to inhibit behaviour, suggest that there was no relationship between self-reported behaviour and actual behaviour expressed by participants. This type of dissociation between self-report and observable behaviour is consistent with findings examining processes and effects generally held to occur without awareness (see Fazio & Olson, 2003 for review). It should be noted that due to the retrospective manner in which participants reported the awareness of their own behaviour, the self-report measures employed did not directly assess awareness during on-going mimicry. However, the evidence from Experiment 6 suggests that mimicry meets Moores and De Houwer's (2007) second proposition regarding unawareness of the output of the automatic process.

The third way that a process may operate without awareness, point (c) the automatic process itself (Moores & De Houwer, 2007), was not directly addressed in Experiment 6. Operating without awareness of the automatic process itself is analogous to participants

reporting the suspicion that the target gesture has influenced their own behaviour during the photo-description task (Bargh & Chartrand, 2000). Participants reporting an awareness that a study is examining mimicry are typically removed from subsequent behavioural analysis (e.g., Chartrand & Bargh, 1999; Gueguen & Martin, 2009; Sanchez-Burks et al., 2009; van Baaren et al., 2003b). In fact, the same method for removing participants for citing these suspicions was used in Experiment 6, and throughout this thesis. However, the present evidence suggests that the mimicry effect is relatively sensitive to awareness of the stimuli that triggers the effect. One could speculate that making participants aware of the target stimuli, as well as its possible influence on their behaviour, would similarly eliminate the mimicry effect. Nonetheless, the evidence from Experiment 6 suggests that two of the characteristics in which mimicry may occur without awareness have been met, namely, unawareness of the stimuli that induces the automatic process (e.g., the target gestures) and the output of the automatic process (e.g., mimicry behaviour expressed) (Moore & De Houwer, 2007).

Refinement of the Mimicry Paradigm

Replication of face-rubbing mimicry behaviour suggests that the current paradigm can be used to reliably demonstrate mimicry. The lack of mimicry observed in the previous chapter was attributed to procedural changes made to the photo-description task. The paradigm used in Experiment 6 returned to the cover story employed in Experiment 2, which emphasised the communicative exchange aspect of the task. The fact that mimicry behaviour was statistically demonstrated in the present experiment would suggest that the context in which the photo-description task is framed is an important component to the mimicry paradigm. Furthermore, the replication of participants' baseline behaviour acting as a significant covariant within the mimicry analysis suggests that the refined baseline measure is preferable to the typically employed one-minute baseline measure. The implications of the differences in cover story and its influence on mimicry behaviour will be discussed further in the next chapter.

The results of the current chapter have provided additional clarity and precision with regard to the automaticity of nonconscious mimicry. Experiment 6 provides compelling evidence that the mimicry effect was eliminated when a relatively modest manipulation of awareness to the general non-verbal behaviour of the actor was introduced. This suggests

that mimicry primarily occurs when the perceiver is unaware of the target gestures and the effect appears to meet the unawareness hallmark as an automatic behaviour. This finding is consistent with the broader literature (Bargh & Chartrand, 2000; Chartrand, 2005; Chartrand & Bargh, 1999; Cheng & Chartrand 2003; Lakin et al., 2008; van Baaren et al., 2009), and further demonstrates the essentially nonconscious nature of the effect. Moreover, the finding that individuals were largely unaware of their change in behaviour when mimicry did occur furthers our understanding of the relationship between nonconscious mimicry and awareness. Importantly, this dissociation between self-report and observable behaviour emphasises the necessity of examining objective measures in addition to subjective measures to clarify inferences made on the automatic processes of nonconscious mimicry. The following chapter will discuss the implications of the findings in Experiments 4 and 5 for our understanding of mimicry's automaticity, in the context of the wider literature.

Chapter Six:

Summary and Conclusions

6.1 Introduction

The current chapter begins by reviewing the main behavioural mimicry findings reported in this thesis. Next, the methodological limitations and implications in relation to the mimicry literature are discussed. Finally, the theoretical implications of these results are considered, as are the possible directions for future research.

6.2 Summary of Findings

This thesis sought to examine the typical methods used to demonstrate the mimicry effect and, in particular, to address the use of appropriate control measures and the presentation of target gestures. A subsequent aim was to investigate the nature of the mechanisms underlying mimicry behaviour. Thus, the first half of this thesis intended to identify and refine a mimicry paradigm that could demonstrate that the tendency to mimic occurs to a greater extent when exposed to target gestures as compared to an equivalent control condition. Having identified a paradigm that reliably demonstrated mimicry behaviour, the second half of the thesis sought to directly assess the automatic nature of nonconscious mimicry by examining the extent to which mimicry operates with efficiency and without awareness.

6.2.1 Identifying a Paradigm to Demonstrate Mimicry Behaviour

Chapter Two aimed to develop a paradigm to demonstrate nonconscious mimicry relative to a suitable control condition and to examine whether the mimicry effect generalised to other gestures not commonly employed in the mimicry literature. A preliminary pilot study identified two new gestures, hair-touching and knee-bouncing, reported by the target population as frequently occurring on a daily basis. These piloted gestures and two typically employed gestures from the mimicry literature, face-rubbing and foot-shaking, were performed by an actor who was video-recorded narrating ‘day in the life’ stories.

Participants were told that the study was examining memory recall when information was presented by videotape, and that they would be asked to recall items mentioned from the stories in the video. Experiment 1a employed a within-participant design in which participants were shown an actor narrating ‘day in the life’ stories both with (piloted or replicated) and without gestures. The results failed to reveal evidence of mimicry. Specifically, participants did not express greater levels of the target gestures, piloted or replicated, when shown the actor performing the target gestures, compared to participant behaviour expressed when shown the actor performing no gestures. The finding that mimicry was not observed was ascribed to the high level of awareness reported in the funnelled debrief, which was probably exacerbated by the contrast of the actor performing the target gestures and no gestures in the within-participant design.

Experiment 1b used the same stimulus videos and cover story. However, a between-participants design was employed in which participants were exposed to either the face-rubbing and foot-shaking gestures or were exposed to no gestures. Thus, the experiment sought to replicate mimicry effects demonstrated in the literature and to address the awareness issues found in Experiment 1a. The lack of mimicry demonstrated and the finding that participants were reporting a high level of awareness of the actor’s behaviour, albeit improved from Experiment 1a, indicated there were problems with the video stimuli and mimicry paradigm used. For this reason, Chapter Three aimed to refine the mimicry paradigm and focused on aspects of gesture presentation, such as duration of exposure and gesture type, to further clarify the conditions under which mimicry could be demonstrated.

6.2.2 The Influence of Gesture Presentation on the Mimicry Effect

For the two experiments reported in Chapter Three, the experimental task was changed to an adapted video version of the photo-description task to more closely mirror conditions previously used in the literature to demonstrate mimicry behaviour. Next, as the within-participant design appeared to elicit greater awareness of the target gestures, the between-participants comparison of gesture and no gesture video stimulus presentation was retained. Since the between-participants design did not allow each participant to provide their own baseline behaviour, as in the within-participant design, a one minute pre-experiment baseline measure of participants’ behaviour was introduced to the mimicry

paradigm. To further address the issues with awareness found in Chapter Two, a new actor was video-recorded performing the target gestures at a lower frequency per minute.

Experiment 2 sought to demonstrate mimicry of the typically employed face-rubbing gesture. A related aim was to better specify the role of exposure duration to the target gestures to produce mimicry effects. The main result of Experiment 2 was that mimicry of face-rubbing behaviour could be shown to occur significantly above the level expressed in the experimentally similar control condition where there was no opportunity to mimic. In addition, the results of Experiment 2 suggested that a longer duration of exposure to the target gestures (e.g., exposure to the stimulus video twice) led to an increase, though not significantly so, in mimicry behaviour as compared to a shorter duration of exposure (e.g., exposure to the stimulus video once). Since a paradigm had been identified to demonstrate mimicry behaviour of the more common face-rubbing gesture, investigation of the generalisability of mimicry could now be explored.

Experiment 3 was designed to replicate the finding that the mimicry effect could be observed in relation to a no gesture condition, and to extend this by investigating whether mimicry behaviour generalised to alternative, more localised, gestures. The main finding of Experiment 3 was that mimicry behaviour was replicated within the refined mimicry paradigm, and that the mimicry effect appeared to generalise to the two new target gestures. Specifically, both cheek-rubbing and ear-touching were expressed at a higher rate when participants were exposed to the respective gestures, compared to those exposed to the actor performing no gestures. Moreover, mimicry behaviour appeared to be specific to the more localised new gestures, as perceiving the cheek-rubbing or ear-touching gestures did not elicit more general face-rubbing mimicry.

Overall, Chapter Three demonstrated that nonconscious mimicry can be observed relative to a tightly controlled no gesture condition with which to compare behavioural changes. In addition, it appears that mimicry behaviour can generalise to new, more localised, gestures. The one minute pre-experiment measure introduced in Chapter Three, however, did not appear to adequately gauge baseline behaviour, as this measure showed exceedingly high levels of gesture expression. This was attributed to differences in the task context (e.g., being left alone in the testing room vs. listening to and describing sets of photographs) and

the time frame in which baseline behaviour was measured, compared to when mimicry behaviour was measured.

6.2.3 The Automaticity of Mimicry Behaviour

Using the same stimulus videos and photo-description task with which mimicry was previously observed, Chapter Four introduced a dual-task digit rehearsal paradigm to directly assess the efficiency of the mimicry effect. As a proposed automatic effect, it was anticipated that mimicry behaviour would be demonstrated above no gesture levels under conditions of both high and low attentional demands. However, the results of Experiment 4 evidenced no more face-rubbing expressed when participants were exposed to the target gesture than in the no gesture conditions, in either high or low cognitive load conditions. To determine if even minimal attentional demands reduced mimicry behaviour, Experiment 5 examined whether mimicry diminished under low load conditions relative to the standard mimicry paradigm similar to that used in the previous chapter. Unexpectedly, Experiment 5 showed that mimicry behaviour was not expressed significantly above no gesture levels in either the standard no digit rehearsal task, or under conditions of low attentional load. This finding was attributed to procedural changes made to the mimicry paradigm in Experiments 4 and 5. Specifically, the cover story given to participants about the purpose of the photo-description task was altered to incorporate the digit-rehearsal element.

Chapter Five sought to continue the examination of the automatic nature of mimicry by investigating the role of awareness in nonconscious mimicry. Specifically, Experiment 6 directly assessed the influence of awareness of the actor's behaviour on the tendency to mimic, as well as participants' awareness of their actual mimicry behaviour, when it occurred. Participants completed the photo-description task, which was an exact replication of the mimicry paradigm used to demonstrate the effect in Experiment 2. Participants were exposed to no gestures or face-rubbing. However, some of the participants exposed to face-rubbing were informed that the actor was 'fidgety', to manipulate awareness. Following completion of the photo-description task, all participants were asked to estimate the frequency that they believed they had touched their face during the experiment.

The results of Experiment 6 showed that when participants were given no prior information about the actor's behaviour, mimicry occurred significantly above the level that face-rubbing was expressed when shown no gestures. When told that the actor was fidgety, however, participant face-rubbing behaviour was reduced to the point where there was no difference to the amount of face-rubbing that was expressed in the no gesture condition. These findings suggested that even a relatively modest manipulation of awareness was sufficient to eliminate the tendency to mimic the actor, and corroborated the interpretation of the results obtained in Experiments 1a and 1b that acute awareness of the actor's behaviour was the most likely cause of mimicry not being demonstrated. In addition, the results showed that when mimicry did occur, participants seemed largely unaware of the changes in their own behaviour due to the presence of the target gesture.

Although the results from Experiments 4 and 5 did not fully ascertain the efficient or inefficient nature of mimicry behaviour, as mimicry was not demonstrated, the results from Experiment 6 provided clear evidence that operating without awareness was essential in obtaining the mimicry effect. These findings in relation to the automaticity of nonconscious mimicry will be discussed later in the chapter. Furthermore, Chapters Four and Five included an improved and more representative pre-experiment baseline measure, which is covered in more detail in section 6.3.

6.2.4 Comparing Behavioural Results Across Chapters

By comparing the behaviour observed across the discussed experiments above (with the exception of Experiment 1a), it is possible to gain a better understanding of the circumstances under which mimicry was, and was not, demonstrated throughout this thesis. In each experiment, measures of participants' frequency per minute expression of target gestures was taken. In addition, because a video based paradigm was employed, participants were exposed to the same actor performing the same set of face-rubbing gestures, with the exception of Experiment 1b and Experiment 3. This allowed for a greater degree of comparability of participant behaviour across experiments. Figure 6.1 shows the six experiments that employed a between-participants comparison of behaviour expressed when exposed to no gestures or target gestures. Specifically, the three experiments on the left of the figure were those in which mimicry was not statistically demonstrated, relative

to a no gesture group. The three experiments on the right of the figure are those in which mimicry was shown to occur compared to a no gesture control condition.

In Experiment 1b, the large error bars indicating a high degree of variability in participants' behaviour, as well as the elevated levels of behaviour expressed in the no gesture condition, highlight the construct validity problems encountered in the initial mimicry paradigm employed in Chapter Two. Also, the comparison of experiments manipulating the face-rubbing (FR) gesture and the two localised cheek-rubbing and ear-touching gestures in Experiment 3 emphasises the more robust tendency to mimic the face-rubbing gesture as compared to the two new target gestures. Furthermore, when face-rubbing was manipulated as the target gesture (not including Experiment 1b), it appeared there was a degree of variability in behaviour expressed in the no gesture condition across experiments. Although it is unclear why behaviour in the gesture present and, particularly, in the no gesture conditions was elevated in Experiment 4, across Experiments 2, 5, and 6 behaviour expressed when exposed to the face-rubbing gesture stayed relatively constant. What is clear, though, is that on occasions where mimicry was not observed, it was not the case that behaviour was reduced in the gesture condition but rather that gesture expression was higher in the respective control conditions. The inability to consistently demonstrate mimicry across experiments possibly reflects some of the methodological issues and limitations encountered throughout this thesis. These will be discussed in relation to the implications these issues have for the methods adopted in the wider mimicry literature.

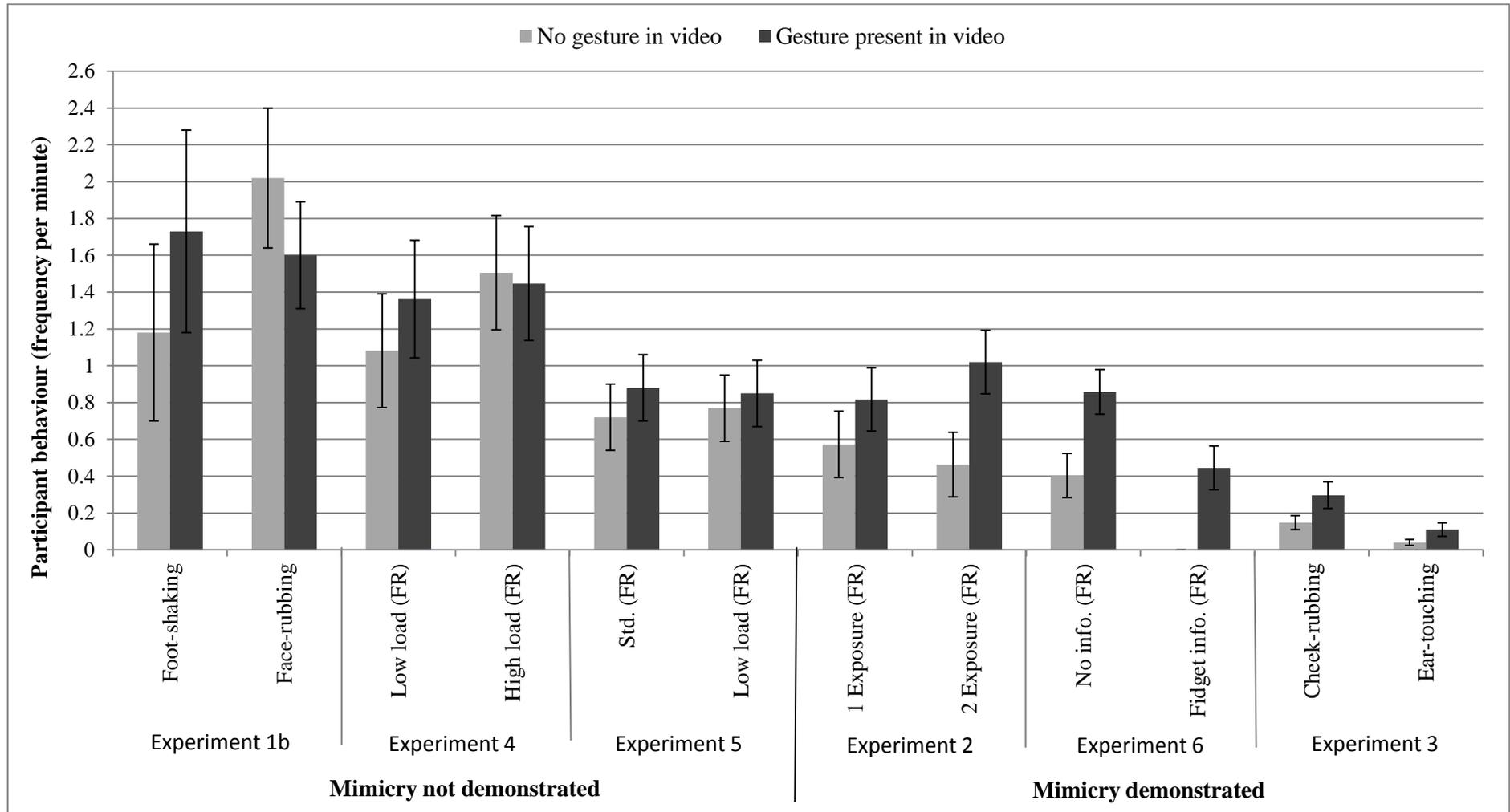


Figure 6.1. Mean participant behaviour expressed (± 1 SEM) as a function of gesture absent and gesture present in the stimulus video across Experiments 1b, 2, 3, 4, 5 and 6. Note: FR = face-rubbing manipulated in experiment, Std. = standard mimicry paradigm.

6.3 Methodological Issues and Implications

6.3.1 The Presentation of Target Gestures

A number of issues arose in identifying a reliable mimicry paradigm with regard to the presentation of the target gestures. Due to the often vague or unspecified reporting of target gestures employed within the mimicry literature (e.g., Chartrand & Bargh, 1999; Cheng & Chartrand, 2003; Lakin & Chartrand, study 2, 2003; Lakin, Chartrand, & Arkin, 2008; van Baaren, Maddux, Chartrand, Bouter, & van Knippenberg, 2003b), the initial creation of the stimulus videos were based largely on guesswork and, therefore, included a high frequency of target gestures in an attempt to maximise the chances of obtaining a mimicry effect. However, the high level of awareness of the target gestures reported by participants was attributed to lack of mimicry demonstrated, an interpretation later supported by the results of Experiment 6. Thus, a greater than anticipated amount of research in this thesis was required to identify a paradigm that demonstrated mimicry, and this limited the investigation of the mechanisms underlying the effect. Moving forward, there is an urgent need for greater transparency within the mimicry literature regarding the specific manipulations used. Implicit measures have been associated, in some instances, with a low level of replicability (Bossen, et al., 2008; LeBel & Paunonen, 2011) relative to explicit counterparts. This makes it all the more important to report the specific manipulations used and the measures of behaviour taken when investigating nonconscious mimicry. Something as fundamental as fully describing and reporting the frequency of the target gestures presented to elicit the mimicry effect would benefit future research seeking to replicate and extend the current findings. The implementation of a video based paradigm is best suited to such an endeavour.

The present experiments employed a video based paradigm because it provided greater control and precision in the manipulation of target gestures. Specifically, it allowed the same frequency, duration and quality (e.g., the same set of actual movements) of behaviour to be presented to all participants. This precision allowed for a more detailed examination of the influence of gesture presentation, such as duration exposure in Experiment 2, presentation of localised gesture type in Experiment 3 and decay effects in Experiment 4, which would not have been possible were a live confederate used. Importantly, the presentation of an actor on video also provided a plausible reason for a video camera to be present to record participant behaviour during the experiments. However, a consistent finding across Experiments 2-6 was that participants reported greater levels of anxiety at

the end of the photo-description task, a finding that was likely attributable to speaking in front of a camera. This increase in anxiety potentially decreased participants' tendency to express mimicry behaviour (Vrijnsen, Lange, Becker, & Rinck, 2010), hindering the ability to consistently demonstrate mimicry across experiments.

An additional limitation to the video based paradigm employed in the present experiments came from the decision to repeat the actor's video-recorded photo-description. This method was implemented in order to increase exposure time to the target gestures and provide a longer window of time to observe participant behaviour. However, the repetition of information may have led to less attentional engagement with the stimulus video (Cheyne, Solman, Carriere, & Smilek, 2009). An alternative method of using longer stimulus videos, which included non-repeating descriptions, may have improved the ability to demonstrate an effect of exposure in Experiment 2 and led to more robust mimicry effects in Experiments 3 and 5. However, after identifying a reliable paradigm in Chapter Three, subsequent experiments attempted to introduce as few procedural changes as possible (e.g., using the same stimulus videos) to allow for a greater degree of comparability across experiments.

The present research may have more limited implications to mimicry behaviour within a live, face-to-face interaction. However, the suggestion of the present findings that a live interaction is not necessary to demonstrate mimicry is in line with evidence from the mimicry literature (e.g., Lakin & Chartrand, study 1, 2003; Parrill & Kimbara, 2006; van Baaren, Horgan, Chartrand, & Dijkmans, study 1, 2004a; van Baaren, Holland, Kawakami, & van Knippenberg, 2006; Yabar, Johnston, Miles, & Peace, 2006). Moreover, a strength of the present thesis is the finding that the mere exposure to target gestures by video presentation is sufficient to elicit mimicry behaviour, against a comparable control condition.

On the other hand, the implementation of this type of control measure could also be considered a weakness in the present thesis. Considering the wide variability of the expression of gestures found across participants in this thesis, it becomes clearer why published research has focused on measuring the relative change in gesture expression (e.g., social and cognitive moderators), rather than the difference from baseline between-participants when examining the mimicry effect. This point will be further discussed in the measures of mimicry behaviour section below. Returning to the interaction characteristics

of the mimicry paradigm, the context in which the video stimulus was presented to participants appeared to be relatively important to demonstrating the effect. Specifically, there seemed to be a trend across experiments that mimicry behaviour was only statistically demonstrated when the cover story and experiment task contained interaction-focused characteristics.

6.3.2 Experiment Task and Cover Story

The use of the adapted photo-description task seemed to be instrumental in obtaining a significant mimicry effect. It was proposed that the photo-description task was more communicative based and mirrored a social interaction to a greater extent than the story recall task employed in Experiments 1a and 1b. This is in line with the suggestion that mimicry is an important facilitator in social interactions (e.g., Ashton-James, van Baaren, Chartrand, Decety, & Karremans, 2007; Chartrand & Bargh, study 2; 1999; Cheng & Chartrand, 2003) and that the majority of research on mimicry behaviour has used relatively interactive based tasks (e.g., Ashton-James & Chartrand, 2009; Karremans & Verwijmeren, 2008; Lakin et al., 2008; van Baaren, Holland, Steenaert, & van Knippenberg, 2004b; Yabar et al., 2006). The present research would suggest that mimicry can be demonstrated when presenting the target gesture via video, but that framing the task with socially oriented information (e.g., that the study was examining communication via video) may be necessary. Of course, a direct test of the influence of context (e.g., social vs. non-social situation) on nonconscious mimicry behaviour still remains to be tested before firm conclusions can be drawn.

A number of issues were encountered in Chapter Four when the photo-description task was further altered in Experiments 4 and 5 to investigate the efficiency of mimicry behaviour. Despite the successful demonstration of mimicry in Chapter Three, mimicry was not demonstrated in Chapter Four. Several changes were made to the paradigm; these included the introduction of the digit rehearsal task and the information given to participants, which seemed to frame the photo-description task in a different context. Although all of the changes made were to address a specific question or unresolved issue, the multiple changes applied to the mimicry paradigm made it difficult to identify which factor was responsible for the lack of mimicry. Therefore, Experiment 6 revisited the successful paradigm used in Experiment 2 and extended it to manipulate awareness. These findings do, however, provide some insight into the limitations and sensitivity of mimicry behaviour. It seems

that relatively subtle changes to the contextual cues in the mimicry paradigm can influence whether mimicry occurs.

Extending this focus across the thesis, the extent to which the interactive qualities of the experiment task affect mimicry behaviour remains unclear. Specifically, when the experiment task included a memory recall component, such as participants' ability to remember and recall objects (Experiment 1a and 1b) or a digit sequence (Experiments 4 and 5), the tendency to mimic was reduced to levels that were no different to behaviour expressed in the no gesture conditions. It is currently unclear whether this relationship between the experiment task and mimicry behaviour is due to the framing the task or if it was because of the working memory components included in Experiments 1a, 1b, 4 and 5. This possibility will be discussed later in relation to mimicry's automaticity.

6.3.3 The Measurement of Behaviour Considered Mimicry

The implementation of an appropriate control condition with which to gauge the occurrence of mimicry behaviour was considered integral to the current body of research. When measuring participants' expression of mimicry behaviour, the mimicry literature has relied on paradigms in which all participants are exposed to the same target gesture(s), and any level of expression of these target gestures has been termed mimicry (e.g., Cheng & Chartrand, 2003; Johnston, 2002; Lakin & Chartrand, 2003; Lakin, et al., 2008; van Baaren et al., 2003b, van Baaren et al., 2004a; Vrijnsen et al., 2010; Yabar et al., 2006). A strength of the present thesis is that the measurement of behavioural changes was compared against behaviour expressed when there was no opportunity to mimic within a similar experimental context. Generally, the direction of means across the experiments does suggest that the tendency to express a perceived behaviour is greater than the tendency to express that same behaviour when no gestures are present. However, it was difficult to reliably demonstrate this change in behaviour at statistically significant levels. One of the biggest difficulties in demonstrating mimicry against this type of comparison was the relatively large variability in participants' behaviour, specifically in the no gesture condition. This was clear in the treatment of behaviour data across experiments, such as removing outliers (e.g., Experiment 2), as well as transforming the data (e.g., Experiments 1a, 1b, 5, and 6), or using adjusted significance values (e.g., Experiment 3) to account for the variable nature of the behaviour observed.

A between-participants method is most common in the mimicry literature (see Table 1.1 in Chapter One for overview), albeit moderating factors are typically manipulated between-participants not behavioural conditions. One of the limitations of the between-participants design was that the control group relied on the average typical gesture expression within the population as a measure of natural baseline behaviour. In contrast, a within-participant design, as used in Experiment 1a, would have provided a direct comparison of the degree to which an individual changed their behaviour upon exposure to a target gesture. The issue with taking an overall mean baseline gesture expression is that there are a number of factors such as gender, personality traits, cognitive abilities and culture (Hostetter & Alibali, 2007), which are suggested to contribute to large individual differences in typical gesture production. This resulted in particularly variable control conditions across experiments that dictated whether mimicry was, or was not, observed.

The limitation of the between-participants design was further highlighted by generally small effect sizes for the observed differences between participants' behaviour in the gesture present and gesture absent conditions. In some instances where the direction of behavioural means were as predicted, but not significantly so, it is possible the sample sizes collected for the between-participants design used were not adequate to detect these relatively small effects. This was particularly highlighted in Experiment 2, where post hoc power analysis indicated a somewhat low probability of finding a difference in mimicry behaviour as a function of duration of exposure to the target gestures. However, the sample sizes taken in the experiments across this thesis (e.g., 20-25 per condition) were in line, if not larger than, those typically taken in between-participants paradigms in the mimicry literature (e.g., Cheng & Chartrand, 2003; Lakin & Chartrand, 2003; Karremans & Verwijmeren, 2008). Rather, it was likely that the higher degree of variability in behaviour between these two gesture groups contributed to the smaller effect sizes (Cohen, 1992).

However, the alternative within-participant comparison could have created a high degree of awareness which dampened the effect in Experiment 1a, and may not have been feasible to implement this in the examination of the automaticity of mimicry behaviour (e.g., Experiments 4, 5 and 6). In addition, the practicality of the participant numbers needed to employ a fully counterbalanced within-participant design made this approach less realistic within the present experiments. Returning to the example of Experiment 2, if a within-participant manipulation of gesture were employed, two different actors would be needed to perform no gestures and face-rubbing to address the issue of awareness in the change in

behaviour between stimulus videos. The actor-gesture performed pairing and order of target gesture and no gesture seen would need to be counterbalanced. An a priori power analysis indicates that, given the effect size found for exposure duration, a sample size of 205 would be needed to achieve the standard 0.80 power to detect an effect in this design.

The pre-experiment baseline measures taken in Experiments 2-6 were anticipated to help account for this issue of individual differences in behaviour expression, and provided a compromise between employing a within- or between-participants design. Specifically, each participant's baseline behaviour was used to examine if the actor's behaviour in video (gesture present or gesture absent) still influenced the participants' expression of the target gesture after the variation of individual behavioural differences, measured at baseline, was removed. A limitation with this type of baseline measure was that it was taken directly after participants arrived to the experiment. Notably, they had just been informed that they would be video-recorded and, thus any nervousness or fidgeting associated with that knowledge (George & Stopa, 2008) would have been included in the baseline measure. Indeed, the initial one minute pre-experiment baseline measure taken in Experiments 2 and 3 showed that participants expressed nearly triple the rate of the target behaviour as compared to the behaviour expressed in either the no gesture or target gesture present conditions. Interestingly, this one minute baseline measure procedure is common within the mimicry literature (e.g., Chartrand & Bargh, 1999; Cheng & Chartrand, 2003; Lakin et al., 2008; Yabar et al., 2006), but did not appear to provide an accurate measure of baseline behaviour in the mimicry paradigm used here. However, when the baseline measure was refined to more closely mirror the conditions, such as the task and timeframe, in which mimicry behaviour was measured, it appeared to provide a more accurate baseline measure in Experiments 4-6. These results imply that this approach to measure baseline behaviour, compared to the traditional one minute measure, should be implemented in future paradigms. Furthermore, introducing a filler task prior to the measurement of baseline behaviour may allow participants time to habituate to the testing room and to the idea of being video-recorded, which may alleviate potential fidgeting concerns discussed above.

Issues such as high individual variation in behaviour, which was improved to some degree by implementing a baseline measure, and the implication of small effect sizes for differences in behaviour between control and gesture present conditions, suggests that the mimicry effect is not necessarily robust under such comparisons. These re-occurring issues throughout this thesis do, however, provide some insight into the unanswered question of

the time course of mimicry behaviour examined in Experiment 4. Given the relatively small effect sizes and difficulties in reliably showing a difference between mimicry behaviour and baseline behaviour, the present results indicate that it is likely that the time course of expressing mimicry is relatively short following exposure to target gestures. While the actual expression of mimicry behaviour may be moderately brief, it is possible that the social consequences that arise from the occurrence of mimicry, such as increased feelings of liking and affiliation (Chartrand & Lakin, 2003), may have a more long term impact on individuals. Thus, examining the decay rate of the social consequences due to the occurrence of mimicry may provide an alternative route to examine the socially applicable aspects of the time course of mimicry behaviour.

However, this thesis does demonstrate the importance of including such a control condition. Returning to Figure 6.1, if the no gesture conditions in Experiment 4 were disregarded one could conceivably conclude that low and high attentional demands increase the tendency to mimic the actor's face-rubbing behaviour when compared to face-rubbing behaviour observed elsewhere in the thesis. This conclusion would suggest that mimicry was not only efficient, but that diminished cognitive resources may even facilitate the effect. However, the implementation of the no gesture conditions led to very different conclusions, namely, that the mimicry effect was not obtained. In line with the present findings, van Baaren et al.'s (2006) study employed a within-participant no gesture and target gesture comparison while examining the moderating effect of mood, and found that mimicry only occurred relative to control levels under certain conditions. Together, these findings may help to explain why the use of (or the publication of the use of) a control condition is uncommon within the mimicry literature when examining an individual's tendency to express mimicry. Specifically, under such comparisons, the mimicry effect may be relatively fragile.

Indeed, research published in the last three years within the mimicry literature suggests that researchers are turning more toward examining the consequences of being mimicked (Ashton-James & Chartrand, 2009; Dalton, Chartrand, & Finkel, 2010; Fischer-Lokou, Gueguen, & Lamy, 2011; Herrmann, Rossberg, Huber, Landwehr, & Henkel, 2011; Jacob, Gueguen, Martin, & Boulbry, 2011; Leander, Chartrand, & Wood, 2011; Sanchez-Burks, Bartel, & Blount, 2009; Stel, van Dijk, & Olivier, 2010; Stel, Rispens, Leliveld, & Lokhorst, 2011; van Baaren, Janssen, Chartrand, & Dijksterhuis, 2009; Vrijssen, Lange, Dotsch, Wigboldus, & Rink, 2009), rather than investigating an individual's tendency to

express mimicry (Castelli, Ravan, Ferrari, & Kashima, 2009; Martin, Gueguen, & Fischer-Lokou, 2010; Gueguen & Martin, 2009; Vrijnsen et al., 2010). This trend in the methods used to examine mimicry, namely to investigate the consequences arising from the participant being mimicked rather than measuring the likelihood of participants expressing mimicry, may reflect broader difficulties in reliably demonstrating mimicry behaviour.

6.4 Theoretical Implications and Directions for Future Research

6.4.1 How Robust is the Mimicry Effect?

In their definition of nonconscious mimicry effects, Chartrand and Bargh (1999) posited that nonconscious mimicry arises because the perception of another's behaviour increases the tendency for the perceiver to engage in that same behaviour. This definition implies that the perceiver's behaviour changes, or increases, from that which they would normally express the given behaviour. Yet the current mimicry literature provides little evidence that participant behaviour changes based on the perception of target gestures, relative to their general tendency to express these relatively common behaviours (e.g., face-rubbing). The approach to reliably demonstrate mimicry behaviour in the present experiments has been to show a significant change in participant behaviour due to the perception of target gestures. This approach seems to better capture Chartrand and Bargh's (1999) initial description of mimicry behaviour, and similar behavioural comparisons have been essential in demonstrating the influence of perceived action on expressed action in imitation effects (Catmur, Walsh, & Heyes, 2009; Brass, Bekkerin, Wohlschlager, & Prinz, 2000; Brass, Bekkerin, & Prinz, 2001; Leighton, Bird, Orsini, & Heyes, 2010). However, the present findings suggest that when viewed against such a comparison the change in participant behaviour due to exposure to target gestures may not be as robust as the published literature implies (*cf.* Bargh, 2005; Chartrand & Dalton, 2009).

It may be that the tendency to mimic is always present to some degree and is more susceptible to increasing or decreasing due to the influence of moderating variables (e.g., Cheng & Chartrand, 2003; Johnston, 2002; Lakin & Chartrand, 2003; Lakin et al., 2008; van Baaren et al., 2004a; Vrijnsen et al., 2010; Yabar et al., 2006). If this is the case, then the approach taken in this thesis, to essentially 'turn on' mimicry when exposing participants to target gestures and 'turn off' mimicry when exposed to no gestures, may not have fully captured the true nature of this effect. However, comparing mimicry observed across the present experiments to similar measures taken within the mimicry literature

would suggest otherwise. The three mimicry studies within the literature that employ the same frequency per minute measure of participant face-rubbing mimicry show relatively similar mean frequencies as the behaviour participants in the present research expressed when exposed to the target gesture (e.g., Chartrand & Bargh, 1999, study 1: $M = 0.57$, study 3: $M = 1.07$; van Baaren et al., 2004a, study 2: $M = 0.42$ face-touches per minute). The difficulty of demonstrating mimicry (relative to a control condition) in the present thesis, which found comparable levels of participant behaviour when exposed to the target face-rubbing gesture to that of previous research, has wider implications for the mimicry field. Namely, the possibility that the reported behavioural changes due to the range of moderating factors that have been examined may not have always reliably been mimicry behaviour. The present findings suggest that caution is needed in interpreting previous demonstrations of mimicry within the literature. Moreover, the apparent fragility of the effect calls into question the extent to which mimicry plays an integral facilitation role in ‘everyday’ social interactions (Chartrand & van Baaren, 2009), considering the effect’s transient nature in laboratory settings.

For these reasons, future research that continues to examine the moderators of nonconscious mimicry must implement control conditions in order to understand the extent to which mimicry behaviour is actually occurring. Furthermore, continuing the examination of the boundary conditions of mimicry, such as the time course of the effect and the perceptual parameters of the target gestures eliciting mimicry behaviour, would provide insight into the optimal conditions required to demonstrate this fragile effect. A better understanding of the scope of mimicry’s occurrence within an interaction is essential to the understanding of how mimicry behaviour can be used as a tool towards social benefits, such as persuasion (van Swol, 2003), recovering from social exclusion (Lakin et al., 2008) and influencing consumer behaviour (Jacob et al., 2011), which are already under investigation within the literature.

There are several refinements that can be made to a control, no gesture, condition to address the issues discussed when employing this measure in future research. The present methods used suggested that a longer period of time to measure participant behaviour is important, via the refinement of the baseline measure and the switch to the longer photo-description task in Chapter Three. These findings imply that a longer period of time to measure participant behaviour may lessen the impact of individual behavioural differences and provide a more accurate measure of behaviour within the experiment task. Thus, one

route of improving a control measure would be to implement a semi-longitudinal study in which behaviour was measured over several test sessions, a method that has proved to be beneficial within the imitation literature (Gillmeister, Catmur, Liepelt, Brass, & Heyes, 2008; Heyes, Bird, Johnson, & Haggard, 2005). Moreover, employing multiple test sessions separated by a week or more would allow a within-participant comparison to be used. This would both minimise the chance of potential carry over effects from one session to the next, as well as bypass the issue of awareness by the direct comparison of an actor performing no gestures and target gestures.

6.4.2 The Underlying Mechanisms of the Mimicry Effect

6.4.2.1 The Automaticity of Mimicry

Many researchers have alluded to the automatic nature of mimicry (Bailenson & Yee, 2005; Bargh & Ferguson, 2000; Chartrand & Bargh, 1999; Karremans & Verwijmeren, 2008; Lakin, 2006; Lakin & Chartrand, 2003; Lakin et al., 2008; Martin et al., 2010; Tanner, Ferraro, Chartrand, Bettman, & van Baaren, 2008; van Baaren et al., 2006). However, the present thesis provided the first empirical evidence that operating without awareness was essential in demonstrating mimicry behaviour. Following the paradigm refinement in Chapter Three approximately 4-6% of participants explicitly reported awareness of the target gesture the actor performed via the traditional awareness check funnelled debrief. This is generally within the acceptable percentage of participants reporting some form of awareness of the target gestures (Chartrand & Bargh, 2000). However, Experiment 6 provided direct evidence that making participants aware of the actor's general behaviour eliminated the mimicry effect. It is important to note that awareness can be viewed as a graded or linear feature, rather than an individual being strictly aware or unaware of an event (Moors & De Houwer, 2007). This may partially explain why mimicry for the more localised new gestures in Experiment 3 was less robust, as awareness of the new gestures was somewhat more elevated relative to awareness levels observed when the face-rubbing gesture was manipulated. Thus, a further step for examining the influence of awareness on mimicry behaviour would be to determine where the awareness threshold lies on this continuum. For instance, subtle degrees of changing, or providing information about, the characteristics of the actor, experimental task or target gestures could be used to manipulate awareness.

Furthermore, the current understanding of the role of awareness was extended by demonstrating that participants were unaware of their own mimicry behaviour when it occurred. Together, these results provide more compelling evidence, relative to the speculative conclusions gathered from retrospective reports (e.g., Ashton-James & Chartrand, 2009; Bailenson & Yee, 2005; Johnston, 2002; Lakin & Chartrand, 2003; Lakin et al., 2008; van Baaren et al., study 3, 2003b; van Baaren et al., study 1, 2004a; Yabar, et al., 2006), that mimicry exhibits the unawareness criterion as an automatic behaviour. These findings place mimicry behaviour more firmly within the defined criteria of automaticity, demonstrating that the effect exhibits at least one of the four fundamental criteria; namely that it operates without awareness, without intention, without control and with high efficiency (Bargh, 1994).

This understanding of the role of awareness in mimicry behaviour has applied implications for the more recent investigation of mimicking health related behaviours. Individuals have been shown to mimic behaviours that promote health, such as mimicking ‘active’ behaviour by taking the stairs rather than the escalator when observing another individual taking the stairs (Webb, Eves, & Smith, 2011), as well as more detrimental behaviours, for instance, mimicking the high alcohol consumption of peers (Borsari & Carey, 2001). In the latter example, mimicry can be seen as maladaptive, however, the present findings would suggest that the mimicker is unlikely to be aware of their own increased consumption behaviour. Following the findings from Experiment 6, awareness of the peer’s consumption behaviour that is triggering mimicry, or the influence of that behaviour on the observer (*cf.*, Chartrand, 2005) could potentially be used as a tool to change this maladaptive mimicry behaviour. For instance, a between-participants manipulation of no information vs. awareness of peers consumption could be employed in a situation where the peer or confederate consumes alcohol or an alternative beverage, such as a soft drink. This would allow for a direct comparison in examining the potential for awareness to suppress or change this maladaptive mimicry behaviour specifically, or if awareness simply suppresses all consumption behaviour (e.g. alcohol and non-alcoholic beverages).

It is unclear, and seems somewhat less likely, whether the awareness of more positive mimicry behaviour, such as mimicking active behaviour (Webb et al., 2011), would also lead to the suppression of that behaviour. However, a potentially more productive avenue of research would be to examine the consequences arising from the awareness of this type of mimicry behaviour. Does an individual’s awareness of the target behaviour (seeing another

individual climbing the stairs) or awareness of their own outcome behaviour (climbing the stairs themselves) lead to, or promote, long term 'active' behavioural changes? In Webb and colleague's study, participants were likely aware of their outcome behaviour (e.g. climbing the stairs to get to a particular destination). However, it remains to be examined whether awareness of the mimicked individual's behaviour, or the influence of that behaviour on the observer's own behaviour, can play a role in modifying long term behaviour.

The present results also raise the question of why awareness decreases the tendency to mimic. The results from Experiment 6 suggest that this tendency was not due to participants perceiving the actor negatively, which has been shown to decrease mimicry behaviour (e.g., Johnston, 2002; Yabar et al., 2006). Future research is needed to clarify whether awareness prompts some kind of inhibitory mechanism. It is possible that awareness stimulates disincentives to mimic another person, such as enhancing an individual's motivation to maintain their individuality, thus creating a high cost of mimicking (Dijksterhuis & Bargh, 2001). Alternatively, awareness of the actor's behaviour may increase self-focus of one's own behaviour, which has been implicated to inhibit automatic behaviour (Wulf, McNevin, & Shea, 2001), and reduce mimicry behaviour (van Baaren et al., 2003b). Further testing that explores the relationships between awareness and conformity, such as the need for uniqueness scale (Snyder & Fromkin, 1977) and self-consciousness, particularly public self-consciousness (Scheier & Carver, 1985), on mimicry behaviour would be the first step to further clarify why awareness reduces mimicry behaviour.

As a proposed automatic effect, mimicry was also predicted to operate with high efficiency. Indeed, automatic social prime-to-behaviour effects and automatic imitation effects, have shown little to no impairment when attentional resources are limited due to dual-task conditions (Bargh & Tota, 1988; Gilbert & Hixon, 1991; van Leeuwen, van Baaren, Martin, Dijksterhuis, & Bekkering, 2009). Moreover, the majority of the influential factors examined in the mimicry literature appear to be bi-directional, such that many of the consequences that arise from being mimicked also appear to moderate the degree to which an individual expresses mimicry (Ashton-James & Chartrand, 2009; Chartrand & Bargh, 1999; Cheng & Chartrand, 2003; van Baaren et al., 2004a). Hence, Dalton, Chartrand and Finkle's (2010) initial evidence that being mimicked spares cognitive resources, making an interaction more efficient, may suggest that the expression

of mimicry behaviour is also efficient. However, the results of Chapter Four were unable to provide conclusive evidence as to whether the amount of mimicry that an individual expresses is moderated by the amount of cognitive resources available.

The demonstration that operating without awareness was necessary to demonstrate mimicry, alongside the lack of demonstration that mimicry is efficient, does not necessarily mean that mimicry is a controlled, rather than an automatic, behaviour. Specifically, as most processes or behaviours are not purely automatic, it is possible that mimicry operates without awareness, but needs some attentional resources to occur, and still be considered automatic (Chartrand & Fitzsimons, 2011; Kihlstrom, 2008; Moors & De Houwer, 2006; 2007). However, the influence of attentional demands on mimicry behaviour requires further attention.

As discussed above, the mimicry effect appeared to be relatively sensitive to the focus or framing of contextual cues. Specifically, when the experiment task did not focus on communicative or interactive characteristics of the task, but on working memory abilities, mimicry was not observed (e.g., Experiments 1a, 1b, 4, 5). Further examination is needed to determine whether mimicry behaviour only occurs when an individual encounters situations with social characteristics. Bargh (1992) suggested that automatic processes may only occur if certain preconditions are met, one of which that was recently demonstrated was that situational factors can create the opportunity for or hamper automatic behavioural responses (Cesario, Plaks, Hagiwara, Navarrete, & Higgins, 2010). If this is the case for nonconscious mimicry, then it would be pertinent in future research to consider whether nonconscious mimicry is efficient once this possible prerequisite of social circumstances is met.

Thus, for future research to move forward to examine the efficiency of the mimicry effect, the influence of context (e.g., social vs. non-social situation) needs first to be explored. Building on the present research, one could measure mimicry behaviour when individuals are told that the photo-description task is examining successful communication (the standard mimicry paradigm used in this thesis). As a non-social context, participants could be given the information that sets of photographs are being piloted for the verbal content of their description (e.g., neutral affect, number items to describe in the photograph, etc.) and they will first see an example description before describing their own set of photographs. Following this, research could then examine the efficiency of the mimicry effect when

employing these social versus non-social context manipulations. This would address the question of nonconscious mimicry's efficiency, and the possibility that mimicry may only operate with efficiency when individuals encounter social oriented situations. Furthermore, a working memory task involving the actor's description of the photographs may provide a more suitable method of examining the efficiency of mimicry. This would maintain attentional focus on the actor and does not detract from the interactive qualities of the task.

The present thesis did not directly assess the last two criteria of automaticity, namely, whether mimicry operates without intention and/or without control. The unintentional criterion stipulates that the mere perception of behaviour can activate or start mimicry behaviour in the absence of the goal to mimic, whereas the uncontrollable criterion suggests that individuals are generally unable to alter, disrupt or stop mimicry behaviour once it has started (Bargh, 1994). It is arguably more difficult to apply a feature-based examination of the automaticity of the mimicry effect to these two criteria because intention and controllability are suggested to be sub-classes of one other. Specifically, an intentional act is controlled because of the goal to alter behaviour and to engage in that act (Moors & De Houwer, 2007). Thus, there may not be sufficient independence between these two automaticity criteria to examine them individually, as opposed to the awareness and efficiency criteria.

Mimicry has been inferred to exhibit these two characteristics of automaticity, but this has been based on evidence provided by retrospective measures of awareness (Chartrand & Bargh, 1999; Lakin & Chartrand, 2003; Vrijssen et al., 2010). It is unclear whether this measure of awareness has the ability to gauge the unintentional and uncontrollable criteria of automaticity. The present findings do suggest that individuals are able to stop or control their mimicry behaviour once their attention is drawn to the behaviour eliciting the effect. However, awareness of an automatic process has been suggested to be at least one precondition for intentional control of that process (Bargh, 1994; Chartrand, 2005; Moors & De Houwer, 2006).

The suggestion that framing the experimental task in a non-social context (versus a social or interactive context) as one explanation for the null findings in Experiments 4 and 5 would suggest that nonconscious mimicry does not meet the unintentional criterion as an automatic behaviour. Although certain conditions may increase or decrease levels of mimicry behaviour, if the mimicry effect were unintentional then the mere perception of

behaviour should produce some observable mimicry behaviour without an activated goal to mimic and regardless of social circumstances. Evidence for this possibility, and as a more direct test for the (un)intentional nature of mimicry, could be gathered by taking a similar methodological approach to that taken in affect priming and imitation research. Regarding the former, it has been demonstrated that informing participants that the primes are unimportant and should be ignored (Hermans, De Houwer & Eelen, 1994) or directing participants to evaluate the semantic properties, not the valence, of primes (De Houwer & Randell, 2004) still leads to affective priming effects. This suggests that participants were not intentionally processing the valence of the primes, because of task instructions, yet an effect of valence on task performance was found (De Houwer, 2006). Likewise, the dissociation in reaction times showing that imitative behaviour occurs more readily than non-imitative behaviour in spite of task instruction has been used to imply that imitation effects are unintentional (Catmur, Walsh & Heyes, 2009; Leighton et al., 2010). Applying this to a video based mimicry paradigm, future research could implement a design in which participants were instructed to follow a moving fixation cross imposed onto the video stimulus, and that the description given by the actor was unimportant and should be ignored. This would conceivably allow for the target gestures to be visually encoded, by following the fixation cross, and to directly test whether mimicry behaviour occurs even when participants are instructed to ignore the actor performing the target gestures.

6.4.2.2 The Perception-Behaviour Link Mechanism

The finding that the perception of a target gesture generally resulted in a greater tendency to express that gesture, which was distinguishable from natural behavioural tendencies, and the indication that the mimicry effect exhibits automatic properties (e.g., operates without awareness) provides further support for the perception-behaviour link mechanism proposed to underlie the mimicry effect (e.g., Chartrand & Bargh, 1999; Chartrand & van Baaren, 2009; Dijksterhuis & Bargh, 2001; Wheeler & DeMarree, 2009). Specifically, the automaticity of mimicry is predictive of this proposed link, such that perception should automatically activate behavioural responses (Bargh, Chen & Burrows, 1996; Chartrand & Bargh, 1999; Dijksterhuis, 2005). The present findings are also consistent with the ideomotor account put forward in the imitation literature (Hommel, Musseler, Aschersleben, & Prinz, 2001; Iacoboni, 2009), which can be considered historically as a precursor to the perception-behaviour link and its application to mimicry effects (Chartrand & Bargh, 1999). Notably, many of the theoretical frameworks that describe the

way in which perception influences behaviour, such as social prime-to-behaviour effects, imitation behaviour and mimicry behaviour, all share very similar proposed mechanisms (Bargh, 2005; Catmur & Heyes, 2009; Dijksterhuis, 2005; Wheeler & DeMarree, 2009). This would suggest that there are strong similarities between the underlying processes of these different automatic effects.

The finding that mimicry does generalise to alternative target gestures is in line with previous findings that imitation effects appear to generalise across a number of actions (Wheaton, Thompson, Syngeniotis, Abbott, & Puce, 2004). It is also consistent with the suggestion that mimicry behaviour is relatively flexible in nature (Dijksterhuis & Bargh, 2001), evident in the many factors that have been identified to moderate the effect. Furthermore, the finding that the perception of the more localised target gestures used to extend the effect (e.g., cheek-rubbing and ear-touching) led to mimicry of the localised gestures alone suggests that the effect shares a degree of sensitivity with that demonstrated in the directed imitation literature (e.g., Brass et al., 2001; Catmur & Heyes, 2010).

However, the reported findings that the amount of exposure duration did not influence mimicry behaviour, suggests that, under some conditions, behaviour activation via perception may influence subsequent observable behaviour differently in mimicry as compared to social prime-to-behaviour effects (Devine, 1989; Dijksterhuis & van Knippenberg, 1998). Furthermore, the current results suggest that the typical dual-task paradigms used to investigate the efficiency of social priming effects and imitation effects may not integrate into mimicry paradigms as effectively. These findings highlight that there may be some discrepancies between social priming, imitation and mimicry in terms of the processes occurring via the perception-behaviour link, which may need to be accounted for in future theoretical frameworks.

It is clear that as these separate bodies of automatic priming literature continue to converge, the mimicry effect shares many underlying features with the imitation effect and social priming effects, as shown to some extent in the present findings pertaining to the generalisability and automaticity of mimicry. However, it remains unclear with regards to mimicry whether the effect fulfils the efficiency criteria and is influenced by exposure duration as does its imitation and social priming counterparts.

The present findings emphasise the need for further investigation into the overlap between these effects. While many of the more recent perception-behaviour link models place mimicry behaviour and social prime-to-behaviour effects under one over-arching mechanism (e.g., Bargh, 2005; Dijksterhuis, 2005; Dijksterhuis, Chartrand, & Bargh, 2007; Ferguson & Bargh, 2004; Wheeler & DeMarree, 2009), evidence from the imitation literature suggests that perception of motor action has a unique effect on observable behaviour compared to the perception of more abstract cues (Brass et al., 2000; Sturmer et al., 2000). However, the present results suggest that relatively abstract cues, such as experimental task context, may influence the relationship between perceived and expressed behaviour. On the other hand, this finding seems to be in line with the proposition from van Baaren and colleagues (2009) who drew links between nonconscious mimicry and the flexibility of the ASL model from the imitation literature. Namely, the authors suggested prior social experiences and expectations, which can be “peripheral” (p. 2386) or abstract in nature, could influence the relationship between perceived and expressed behaviour based on these learned associations (van Baaren et al., 2009). Thus, closer examination of the extent to which these frameworks, in automatic social priming, imitation and mimicry, are related and diverge will promote a better understanding for the mechanisms underlying nonconscious mimicry.

6.5 Conclusions

This thesis sought to critically evaluate the methodological approaches employed to demonstrate nonconscious mimicry behaviour, and to establish ways in which these might be refined to help better understand the mechanisms underlying the mimicry effect. The reported results illustrate the benefits and costs associated with introducing a control condition to distinguish the extent to which mimicry behaviour is observed. As well as informing recommendations for the future implementation of control groups, the results underscore the need for researchers to adopt greater transparency when describing the details of their mimicry paradigms. This thesis also extended current knowledge of the automatic nature of mimicry behaviour, which has received little attention within the mimicry literature. The present findings have likewise raised a number of important questions regarding the situational circumstances and automatic manner in which mimicry behaviour may occur. Answers to these questions will help to bridge the gap in understanding between the social functions of nonconscious mimicry and the mechanisms underlying the phenomenon.

References

- Aarts, H., & Dijksterhuis, A. (2003). The silence of the library: Environment, situational norm, and social behavior. *Journal of Personality and Social Psychology*, *84* (1), 18-28.
- Aicken, M. D., Wilson, A. D., Williams, J. H. G., & Mon-Williams, M. (2007). Methodological issues in measures of imitative reaction times. *Brain and Cognition*, *63*, 304-308.
- Ashton-James, C. E., & Chartrand, T. L. (2009). Social cues for creativity: The impact of behavioral mimicry on convergent and divergent thinking. *Journal of Experimental Psychology*, *45*, 1036-1040.
- Ashton-James, C. E., van Baaren, R., Chartrand, T., Decety, J., & Karremans, J. (2007). Mimicry and me: The impact of mimicry on self-construal. *Social Cognition*, *25*(4), 518-535.
- Baddeley, A. (1997). *Human memory: Theory and practice*. Hove: Psychology Press.
- Bailenson, J. N., & Yee, N. (2005). Digital Chameleons: Automatic assimilation of nonverbal gestures in immersive virtual environments. *Psychological Science*, *16* (10), 814-819.
- Bargh, J. A. (1992). The ecology of automaticity: Toward establishing the conditions needed to produce automatic processing effects. *American Journal of Psychology*, *105*(2), 181-199.
- Bargh, J. A. (1994). The four horsemen of automaticity: Awareness, intention, efficiency, and control in social cognition. In R. Wyer & T. Srull (Eds.), *Handbook of social cognition: Basic Processes* (Vol. 1) (pp. 1-40). New Jersey: Lawrence Erlbaum Associates.
- Bargh, J. A. (2005). Bypassing the will: Toward demystifying the nonconscious control of social behaviour. In R. R. Hassin, J. S. Uleman, & J. A. Bargh (Eds.), *The New Unconscious* (pp. 37-58). New York: Oxford University Press.
- Bargh, J. A., & Chartrand, T. L. (1999). The unbearable automaticity of being. *American Psychologist*, *54*(7), 462-479.
- Bargh, J. A., & Chartrand, T. L. (2000). The mind in the middle: A practical guide to priming and automaticity research. In H. Reis, C. Judd (Ed.), *Research methods in social psychology* (pp. 253-285). New York: Cambridge University Press.
- Bargh, J. A., Chen, M., & Burrows, L. (1996). Automaticity of social behavior: Direct effects of trait construct and stereotype activation on action. *Journal of Personality and Social Psychology*, *71*(2), 230-244.
- Bargh, J. A., & Tota, M. E. (1988). Context-dependent automatic processing in depression: Accessibility of negative constructs with regard to self but not others. *Journal of Personality and Social Psychology*, *54*, 925-939.

- Berkowitz, L. (1984). Some effects of thoughts on the anti- and prosocial influences of media events: A cognitive neoassociationistic analysis. *Psychological Bulletin*, *95*, 410-427.
- Bertenthal, B.I., Longo, M.R., & Kosobud, A. (2006). Imitative response tendencies following observation of intransitive actions. *Journal of Experimental Psychology: Human Perception and Performance*, *32*, 210–225.
- Blakemore, S., & Frith, C. (2005). The role of motor contagion in the prediction of action. *Neuropsychologia*, *43*, 260-267.
- Bindemann, M., Burton, M. A., Hooge, I. T. C., Jenkins, R., & de Haan, E. H. F. (2005). Faces retain attention. *Psychonomic Bulletin & Review*, *12* (6), 1048-1053.
- Bodenhausen, G. V., Macrae, N. C., & Hugenberg, K. (2003). Social Cognition. In T. Millon, M. J. Lerner, & I. B. Weiner (Eds.), *Handbook of Psychology: Personality and Social Psychology* (Vol. 5). New Jersey: John Wiley & Sons, (pp. 257-282).
- Borsari, B., & Carey, K. B. (2001). Peer influences on college drinking: A review of the research. *Journal of Substance Abuse*, *13*, 391-424.
- Bosson, J. K., Lakey, C. E., Campbell, W. K., Zeigler-Hill, V., Jordan, C. H., & Kernis, M. H. (2008). Untangling the links between narcissism and self-esteem: A theoretical and empirical review. *Personality and Social Psychology Compass*, *2/3*, 1415-1439.
- Brass, M., Bekkering, H., & Prinz, W. (2001). Movement observation affects movement execution in a simple response task. *Acta Psychologica*, *106*, 3-22.
- Brass, M., Bekkerin, H., Wohlschlager, A., & Prinz, W. (2000). Compatibility between observed and executed finger movements: Comparing symbolic, spatial, and imitative cues. *Brain and Cognition*, *44*(2), 124-143.
- Brass, M., Derrfuss, J., & von Cramon, D. Y. (2005). The inhibition of imitative and overlearned responses: A functional double dissociation. *Neuropsychologia*, *42*, 89-98.
- Brass, M., & Heyes, C. (2005). Imitation: Is cognitive neuroscience solving the correspondence problem? *Trends in Cognitive Sciences*, *9*(10), 489-495.
- Buccino, G., Binkofski, F., Fink, G. R., Fadiga, L., Fogassi, L., Gallese, V., Seitz, R. J., Zilles, K., Rizzolatti, G., & Freund, H. J. (2001). Action observation activates premotor and parietal areas in a somatotopic manner: An fMRI study. *European Journal of Neuroscience*, *13*, 400–404.
- Castelli, L., Pavan, G., Ferrari, E., & Kashima, Y. (2009). The stereotyper and the chameleon: The effects of stereotype use on perceivers' mimicry. *Journal of Experimental Social Psychology*, *45*(4), 835-839.

- Catmur, C., & Heyes, C. (2010). Time course analyses confirm independence of imitative and spatial compatibility. *Journal of Experimental Psychology: Human Perception and Performance*, 37(2), 409-421.
- Catmur, C., Gillmeister, H., Bird, G., Liepelt, R., Brass, M., & Heyes, C. (2008). Through the looking glass: counter-mirror activation following incompatible sensorimotor learning. *European Journal of Neuroscience*, 28, 1208-1215.
- Catmur, C., Mars, R. B., Rushworth, M. F., & Heyes, C. (2011). Making Mirrors: Premotor cortex stimulation enhances mirror and counter-mirror motor facilitation. *Journal of Cognitive Neuroscience*, 23(9), 2352-2362.
- Catmur, C., Walsh, V., & Heyes, C. (2009). Associative sequence learning: the role of experience in the development of imitation and the mirror system. *Philosophical Transactions of the Royal Society of Biological sciences*, 364, 2369-2380.
- Cesario, J., Plaks, J. E., Hagiwara, N., Navarrete, C. D., & Higgins, E. T. (2010). The ecology of automaticity: How situational contingencies shape action semantics and social behavior. *Psychological Science*, 21(9), 1311-1317.
- Chartrand, T. (2005). The Role of Conscious awareness in consumer behavior. *Journal of consumer psychology*, 15(3), 203-210.
- Chartrand, T. L., & Bargh, J. A. (1999). The chameleon effect: The perception-behavior link and social interaction. *Journal of Personality and Social Psychology*, 76(6), 893-910.
- Chartrand, T. L., & Dalton, A. N. (2009). Mimicry: It's ubiquity, importance, and functionality. In E. Morsella, J. A. Bargh & P. M. Gollwitzer (Eds.), *Oxford handbook of human action* (pp. 458-483). New York: Oxford University Press.
- Chartrand, T. L., & Fitzsimons, G. J. (2011). Nonconscious consumer psychology. *Journal of Consumer Psychology*, 21, 1-3.
- Chartrand, T. L., Maddux, W. W., & Lakin, J. L. (2005). Beyond the perception-behavior link: The ubiquitous utility and motivational moderators of nonconscious mimicry. In R. Hassin, J. Uleman & J. A. Bargh (Eds.), *Unintended thought II: The new unconscious*. New York: Oxford University Press.
- Chartrand, T. L., & van Baaren, R. (2009). Human Mimicry. *Advances in Experimental Social Psychology*, 41, 219-274.
- Cheng, C. M., & Chartrand, T. L. (2003). Self-monitoring without awareness: Using mimicry as a nonconscious affiliation strategy. *Journal of Personality and Social Psychology*, 85(6), 1170-1179.
- Cheyne, J. A., Solman, G. J. F., Carriere, J. S. A., & Smilek, D. (2009). Anatomy of an error: A bidirectional state model of task engagement/disengagement and attention-related errors. *Cognition*, 111, 98-113.
- Cohen, J (1992). A power primer. *Psychological Bulletin*, 112, 155-159.

- Corallo, G., Sackur, J., Dehaene, S., & Sigman, M. (2008). Limits on introspection: Distorted subjective time during the dual-task bottleneck. *Psychological Science*, *19* (11), 1110-1117.
- Craigheero, L., Bello, A., Fadiga, L., & Rizzolatti, G. (2002). Hand action preparation influences the responses to hand pictures. *Neuropsychologia* *40*, 492–502.
- Dalton, A. N., Chartrand, T. L., & Finkel, E. J. (2010). The schema-driven chameleon: How mimicry affects executive and self-regulatory resources. *Journal of Personality and Social Psychology*, *98* (4), 605-617.
- De Houwer, J. (2006). What are implicit measures and why are we using them. In R. W. Wiers & A. W. Stacy (Eds.), *The handbook of implicit cognition and addiction* (pp. 11-28). Thousand Oaks, CA: Sage Publishers.
- De Houwer, J., & Randell, T. (2004). Robust affective priming effects in a conditional pronunciation task: Evidence for the semantic representation of evaluative information. *Cognition and Emotion*, *18*, 251-264.
- Devine, P. G (1989). Stereotypes and prejudice: Their automatic and controlled components. *Journal of Personality and Social Psychology*, *56*, 5-18.
- Dijksterhuis, A. (2005). Why we are social animals: The high road to imitation and social glue. In S. Hurley & N. Chater (Eds.), *Perspectives on imitation: from neuroscience to social science* (Vol. 2.). Cambridge, MA: MIT press.
- Dijksterhuis, A., & Aarts, H. (2010). Goals, attention, and (un)consciousness. *Annual Review of Psychology*, *61*, 467-490.
- Dijksterhuis, A., & Bargh, J. A. (2001). The perception-behavior expressway: automatic effects of social perception on social behavior. In M. P. Zanna (Ed.), *Advances in Experimental Social Psychology* (Vol. 33) (pp. 1-40). London: Academic Press.
- Dijksterhuis, A., Chartrand, T. L., & Aarts, H. (2007). Effects of priming and perception on social behavior and goal pursuit. In J. A. Bargh (Ed.), *Social Psychology and the Unconscious: The Automaticity of Higher Mental Processes* (pp. 51-115). New York: Psychology Press.
- Dijksterhuis, A., & van Knippenberg, A. (1998). The relation between perception and behavior, or how to win a game of trivial pursuit. *Journal of Personality and Social Psychology*, *74*(4), 865-877.
- Dimberg, U. (1997). Facial reactions: Rapidly evoked emotional responses. *Journal of Psychophysiology*, *11*, 115–123.
- Dimberg, U., Thunberg, M., & Elmehed, K. (2000). Unconscious facial reactions to emotional facial expressions. *Psychological Science*, *11* (1), 86-89.
- Ekman, P., & Friesen, W. V. (1969). The repertoire of nonverbal behavior: Categories, origins, usage, and coding. *Semiotica*, *1*, 49-98.

- Ericsson, A.K., & Simon, H.A. (1980). Verbal reports as data. *Psychological Review*, 87 (3), 215-251.
- Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, 39, 175-191.
- Fazio, R. H., & Olson, M. A. (2003). Implicit measures in social cognition research: Their meaning and use. *Annual Review of Psychology*, 54, 297-327.
- Ferguson, M. J., & Bargh, J. A. (2004). How social perception can automatically influence behavior. *Trends in Cognitive Sciences*, 8(1), 33-39.
- Field, A. (2005). *Discovering statistics using SPSS* (2nd ed.). London: Sage Publications.
- Finkel, E., Campbell, W., Brunell, A., Dalton, A., Scarbeck, S., & Chartrand, T. (2006). High-maintenance interaction: Inefficient social coordination impairs self-regulation. *Journal of Personality and Social Psychology*, 91(3), 456-475.
- Fischer-Lokou, J., Martin, A., Gueguen, N., & Lamy, L. (2011). Mimicry and propagation of prosocial behavior in a natural setting. *Psychological Reports*, 108 (2), 599-605.
- Forster, J., Liberman, N., & Friedman, R. S. (2007). Seven principles of goal activation: A systematic approach to distinguishing goal priming from priming of non-goal constructs. *Personality and Social Psychology Review*, 11, 211-233.
- Gallese, V., & Goldman, A. (1998). Mirror neurons and the simulation theory of mind-reading. *Trends in cognitive sciences*, 2 (12), 493-501.
- Gallese, V., Keysers, C., & Rizzolatti, G. (2004). A unifying view of the basis of social cognition. *Trends in Cognitive Science*, 8 (9), 396-403.
- Garson, D. G. (2009). " Univariate GLM ", from *Statnotes: Topics in Multivariate Analysis*. Retrieved 20/02/2010 from <http://faculty.chass.ncsu.edu/garson/pa765/statnote.htm>.
- George, L., & Stopa, L. (2008). Private and public self-awareness in social anxiety. *Journal of Behavior Therapy and Experimental Psychiatry*, 39 (1), 57-72.
- Gilbert, D., & Hixon, G. (1991). The trouble of thinking: Activation and application of stereotypic beliefs. *Journal of Personality and Social Psychology*, 60 (4), 509-517.
- Gilbert, D. T., & Malone, P. S. (1995). The correspondence bias. *Psychological Bulletin*, 117 (1), 21-38.
- Gilbert, D. T., Pelham, B. W., & Krull, D. S. (1988). On cognitive busyness when person perceivers meet persons perceived. *Journal of Personality and Social Psychology*, 54 (5), 733-740.
- Gillmeister, H., Catmur, C., Liepelt, R., Brass, M., & Heyes, C. (2008). Experience-based priming of body parts: A study of action imitation. *Brain Research*, 1217, 157-170.

- Greenwald, A. G. (1970). Sensory feedback mechanisms in performance control: With special reference to the ideomotor mechanism. *Psychological Review*, 77 (2), 73-99.
- Gueguen, N., Jacob, C., & Martin, A. (2009). Mimicry in social interaction: Its effect on human judgment and behaviour. *European Journal of Social Sciences*, 8 (2), 253-259.
- Gueguen, N., & Martin, A. (2009). Incidental similarity facilitates behavioral mimicry. *Social Psychology*, 40 (2) 88-92.
- Hatfield, E., Cacioppo, J. T., & Rapson, R. L. (1993). Emotional contagion. *Current Directions in Psychological Science*, 2 (3), 96-99.
- Haslinger, B., Erhard, P., Altenmüller, E., Schroeder, U., Boecker, H., & Ceballos-Baumann, A. O. (2005). Transmodal sensorimotor networks during action observation in professional pianists. *Journal of Cognitive Neuroscience* 17, 282-293.
- Heiser M., Iacoboni M., Maeda F., Marcus J., & Mazziotta J. C. (2003). The essential role of Broca's area in imitation. *European Journal of Neuroscience*, 17, 1123-28.
- Hermans, D., De Houwer, J., & Elen, P. (1994). The affective priming effect: Automatic activation of evaluative information in memory. *Cognition and Emotion*, 8, 515-533.
- Herrmann, A., Rossberg, N., Huber, F., Landwehr, & J. R., Henkel, S. (2011). The impact of mimicry on sales- Evidence from field and lab experiments. *Journal of Economic Psychology*, 32, 502-514.
- Hess, U., & Blair, S. (2001). Facial mimicry and emotional contagion to dynamic emotional facial expressions and their influence on decoding accuracy. *International Journal of Psychophysiology*, 40 (2) 129-141.
- Heyes, C. (2001). Causes and consequences of imitation. *Trends in Cognitive Sciences*, 5 (6), 253-261.
- Heyes, C. (2009). Evolution, development and intentional control of imitation. *Philosophical Transactions of the Royal Society of Biological Sciences*, 364, 2293-2298.
- Heyes, C. (2010). Where do mirror neurons come from? *Neuroscience and Biobehavioral Reviews*, 34, 575-583.
- Heyes, C., Bird, G., Johnson, H., & Haggard, P. (2005). Experience modulates automatic imitation. *Cognitive Brain Research*, 22, 233-240.
- Higgins, E. T. (1996). Knowledge activation: Accessibility, applicability, and salience. In E. T. Higgins & A. W. Kruglanski (Eds.), *Social psychology: Handbook of basic principles* (pp. 133-168). New York: Guilford.

- Hommel, B. (1995). Stimulus-response compatibility and the Simon effect: Toward an empirical clarification. *Journal of Experimental Psychology: Human Perception and Performance*, 21 (4), 764-775.
- Hommel, B., Musseler, J., Aschersleben, G., & Prinz, W. (2001). The theory of event coding (TEC): A framework for perception and action planning. *Behavioral and Brain Sciences*, 24, 849-937.
- Hostetter, A. B., & Alibali, M. W. (2007). Raise your hand if you're spatial: Relations between verbal and spatial skills and gesture production. *Gesture*, 7 (1), 73-95.
- Hughes, A. A., Heimberg, R. G., Coles, M. E., Bigg, B. E., Liebowitz, M. R., & Schneier, F. R. (2006). Relations of the factors of the tripartite model of anxiety and depression to types of social anxiety. *Behaviour Research and Therapy*, 44, 1629-1641.
- Iacoboni, M. (2005). Neural mechanisms of imitation. *Current Opinion in Neurobiology*, 15, 632-637.
- Iacoboni, M. (2009). Imitation, empathy, and mirror neurons. *Annual Review of Psychology*, 60, 653-670.
- Iacoboni, M., Woods, R. P., Brass, M., Bekkering, H., Mazziotta, J. C., & Rizzolatti, G. (1999). Cortical mechanisms of human imitation. *Science*, 286, 2526-2528.
- Jack A. I., & Roepstorff, A. (2003). Why trust the subject? *Journal of Consciousness Studies*, 10 (9-10), v-xx.
- Jack, A. I., & Shallice, T. (2001). Introspective physicalism as an approach to the science of consciousness. *Cognition*, 79, 161-196.
- Jacob, C., Gueguen, N., Martin, A., & Boulbry, G. (2011). Retail salespeople's mimicry of customers: Effects on consumer behavior. *Journal of Retailing and Consumer Services*, 18, 381-388.
- James, W. (1890). *The principles of psychology*. New York: Holt.
- Jansson, E. (2007). Methodological problems undermine tests of the ideo-motor conjecture. (Masters dissertation). University of Aberdeen, Aberdeen, Scotland.
- Jeannerod, M. (2001). Neural simulation of action: A unifying mechanism for motor cognition. *NeuroImage*, 14, S103-S109.
- Johnston, L. (2002). Behavioral mimicry and stigmatization. *Social Cognition*, 20 (1), 18-35.
- Karremans, J. C., & Verwijmeren, T. (2008). Mimicking attractive opposite-sex others: The role of romantic relationship status. *Personality and Social Psychology Bulletin*, 34 (7), 939-950.
- Kenny, D. A. (2011). "Mediation". Retrieved 12/01/2012 from <http://davidakenny.net/cm/mediate.htm>.

- Kihlstrom, J. F. (2008). The automaticity juggernaut. In J. Baer, J. C. Kaufman, & R. F. Baumeister (Eds.), *Are we free? Psychology and free will* (pp. 155-180). New York: Oxford University Press.
- Kilner, J. M., Paulignan, Y., & Blakemore, S. J. (2003). An interference effect of observed biological movement on action. *Current Biology*, *13*, 522-525.
- Koski, L., Wohlschlagel, A., Bekkering, H., Woods, R. P., Dubeau, M., Mazziotta, J. C., & Jacoboni, M. (2002). Modulation of motor and premotor activity during imitation of target-directed actions. *Cerebral Cortex* *12*, 847-855.
- Kuhnen, U., Hannover, B., & Schubert, B. (2001). The semantic-procedural-interface model of the self: The role of self-knowledge for context-dependent versus context-independent modes of thinking. *Journal of Personality and Social Psychology*, *80*, 397-409.
- LaFrance, M. (1979). Nonverbal synchrony and rapport: Analysis by the cross-lag panel technique. *Social Psychology Quarterly*, *42*, 66-70.
- LaFrance, M. (1985). Postural mirroring and intergroup relations. *Personality and Social Psychology Bulletin*, *11* (2), 207-217.
- Lakin, J. (2006). Automatic cognitive processes and nonverbal communication. In V. Manusov, Patterson, M. (Ed.), *The Sage Handbook of Nonverbal Communication* (pp. 59-77). New York: Sage Publications.
- Lakin, J. L., & Chartrand, T. L. (2003). Using nonconscious behavioral mimicry to create affiliation and rapport. *Psychological Science*, *14* (4), 334-339.
- Lakin, J. L., Chartrand, T. L., & Arkin, R. M. (2008). I am too just like you. Nonconscious mimicry as an automatic behavioral response to social exclusion. *Psychological Science*, *19* (8), 816-822.
- Lakin, J., Jefferis, V., Cheng, C., & Chartrand, T. L. (2003). The chameleon effect as social glue: Evidence for the evolutionary significance of nonconscious mimicry. *Journal of Nonverbal Behavior*, *27* (3), 145-162.
- Lang, P. J. (1985). The cognitive psychophysiology of emotion: Fear and anxiety. In A. H. Tuma & J. D. Master (Eds.), *Anxiety and the anxiety disorders* (pp. 131-170). Hillsdale, NJ: Erlbaum.
- Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1997). *International affective picture system (IAPS): Technical manual and affective rating*. Gainesville: University of Florida, Center for Research in Psychophysiology.
- Leander, N. P., Chartrand, T. L., & Wood, W. (2011). Mind your mannerisms: Behavioral mimicry elicits stereotype conformity. *Journal of Experimental Social Psychology*, *47* (1), 195-201.
- LeBel, E. P., & Paunonen, S. V. (2011). Sexy but often unreliable: The impact of unreliability on the replicability of experimental findings with implicit measures. *Personality and Social Psychology Bulletin*, *37* (4), 570-583.

- Leighton, J., Bird, G., & Heyes, C. (2010). 'Goals' are not an integral component of imitation. *Cognition*, *114*, 423-435.
- Leighton, J., Bird, G., Orsini, C., & Heyes, C. (2010). Social attitudes modulate automatic imitation. *Journal of Experimental Social Psychology*, *46*, 905-910.
- Leighton, J., & Heyes, C. (2010). Hand to mouth: Automatic imitation across effector systems. *Journal of Experimental Psychology: Human perception and performance*, *36* (5), 1174-1183.
- Liepelt, R., von Cramon, D. Y., & Brass, M. (2008). What is matched in direct matching? Intention attribution modulates motor priming. *Journal of Experimental Psychology: Human Perception and Performance*, *34* (3), 578-591.
- Lippa, Y. (1996). A referential-coding explanation for compatibility of physically orthogonal stimulus and response dimensions. *Quarterly Journal of Experimental Psychology*, *49A*, 950 – 971.
- Longo, M. R., & Bertenthal, B. I. (2004). Automaticity and inhibition in action planning. *Behavioral and Brain Sciences*, *27*, 44-45.
- Longo, M. R., Kosobud, A., & Bertenthal, B. I. (2008). Automatic imitation of biomechanically possible and impossible actions: Effects of priming movements versus goals. *Journal of Experimental Psychology: Human Perception & Performance*, *34* (2), 489-501.
- Martin, A., Gueguen, N., & Fischer-Lokou, J. (2010). The impact of guilt on mimicry behavior. *Social Behavior and Personality*, *38* (7), 987-992.
- MacKinnon, D. P., Fairchild, A. J., & Fritz, M. S. (2007). Mediation Analysis. *Annual Review of Psychology*, *58* (5), 593-614.
- MacLeod, C. M. (1991). Half a century of research on the Stroop effect: An integrative review. *Psychological Bulletin*, *109*, 163–203.
- Maddux, W. W., Mullen, E., & Galinsky, A. D. (2008). Chameleons bake bigger pies and take bigger pieces: Strategic behavioral mimicry facilitates negotiation outcomes. *Journal of Experimental Social Psychology*, *44* (2), 461-468.
- Manstead, A. S. R., & Hewstone, M. (Eds.) (1995). *The Blackwell Encyclopaedia of Social Psychology* (p. 78). Cambridge: Basil Blackwell.
- Mehrabian, A., & Friedman, S.L. (1986). An analysis of fidgeting and associated individual-differences. *Journal of Personality*, *54* (2), 406-429.
- Mehrabian, A., & Ljunggren, E. (1997). Dimensionality and content of optimism-pessimism analysed in terms of the PAD temperament model. *Personality and Individual Differences*, *23* (5) 729-737.
- Meltzoff, A. N., & Prinz, W. (Eds.) (2002). *The imitative mind: Development, evolution, and brain bases*. Cambridge: Cambridge University Press.

- Moody, E. J., McIntosh, D. N., Mann, L. J., & Weisser, K. R. (2007). More than mere mimicry? The influence of emotion on rapid facial reactions to faces. *Emotion, 7* (2), 447-457.
- Molnar-Szakacs, I., Iacoboni, M., Koski, L., & Mazziotta, J. C. (2004). Functional segregation within pars opercularis of the inferior frontal gyrus: Evidence from fMRI studies of imitation and action observation. *Cerebral Cortex, 23*, 1440–1449.
- Moors, A., & De Houwer, J. (2006). Automaticity: A theoretical and conceptual analysis. *Psychological Bulletin, 132* (2), 297-326.
- Moors, A., & De Houwer, J. (2007). What is Automaticity? An analysis of its component features and their interrelations. In J. Bargh (Ed.), *Social psychology and the unconscious: the automaticity of higher mental processes* (pp. 11-115). New York: Psychology Press.
- Muhlau, M., Hermsdorfer, J., Goldenberg, G., Wohlschlagel, A. M., Castrop, F. Stahl, R., Rottinger, M., Erhard, P., Haslinger, B., Ceballos-Beumann, A. O., & Conrad, B., Boecher, H. (2005). Left inferior parietal dominance in gesture imitation: an fMRI study. *Neuropsychologia 43*, 1086–1098.
- Naparstek, S., & Henik, A. (2010). Count me in! On the automaticity of numerosity processing. *Journal of Experimental Psychology: Learning, Memory, & Cognition, 36* (4), 1053-1059.
- Niedenthal, P. M., Brauer, M., Halberstadt, J. B., & Innes-Ker, A. H. (2001). When did her smile drop? Facial mimicry and the influences of emotional state on the detection of change in emotional expression. *Cognition and Emotion, 15*, 853–864.
- Nisbett, R., & Wilson, T. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological Review, 84*, 231-259.
- The Observer (2003). Wageningen, The Netherlands: Noldus Information Technology b.v.
- Parril, F., & Kimbara, I. (2006). Seeing and hearing double: The influence of mimicry in speech and gesture on observers. *Journal of Nonverbal Behavior, 30*, 157-166.
- Poldrack, R. A., Sabb, F. W., Foerde, K., Tom, S. M., Asarnow, R. F., Bookheimer, S.Y., & Knowlton, B. J. (2005). The Neural Correlates of Motor Skill Automaticity. *The Journal of Neuroscience, 25* (22), 5356 –5364.
- Pratto, F., & Bargh, J. A. (1991). Stereotyping based on apparently individuating information: Trait and global components of sex stereotypes under attentional overload. *Journal of Experimental Social Psychology, 27*, 26-47.
- Press, C., Bird, G., Flach, R., & Heyes, C. (2005). Robotic movement elicits automatic imitation. *Cognitive Brain Research, 25* (3), 632-640.
- Press, C., Bird, G., Walsh, E., & Heyes, C. (2008). Automatic imitation of intransitive actions. *Brain and Cognition, 67*, 44-50.

- Prinz, W. (1997). Perception and action planning. *European journal of cognitive psychology*, 9 (2), 129-154.
- Prinz, W. (2002). Experimental Approaches to Imitation. In A. N. Meltzoff & W. Prinz (Eds.) *An introduction to the imitative mind and brain* (pp. 143-162). Cambridge: Cambridge University Press.
- Prinz, W. (2005). An Ideomotor Approach to Imitation. In S. Hurley & N. Chater (Eds.) *Mechanisms of imitation and imitation in animals* (pp. 141-156). Cambridge, MA: MIT Press.
- Raab, G. M., Day, S., & Sales, J. (2000). How to select covariates to include in the analysis of a clinical trial. *Controlled Clinical Trials*, 21, 330-342.
- Rizzolatti, G., & Craighero, L. (2004). The mirror-neuron system. *Annual Review of Neuroscience*, 27, 169-192.
- Rizzolatti, G., Fogassi, L., & Gallese, V. (2001). Neurophysiological mechanisms underlying the understanding and imitation of action. *Nature Reviews Neuroscience*, 2, 661-670.
- Salvucci, D. D., & Beltowska, J. (2008). Effects of memory rehearsal on driver performance: Experiment and theoretical account. *Human Factors*, 50 (5), 834-844.
- Sanchez-Burks, J., Bartel, C. A., & Blount, S. (2000). Performance in intercultural interactions at work: cross-cultural differences in response to behavioral mirroring. *Journal of Applied Psychology*, 94 (1), 216-223.
- Scheier, M. F., & Carver, C. S. (1985). The self-consciousness scale: A revised version for use with general populations. *Journal of Applied Social Psychology*, 15 (8), 687-699.
- Schooler, J. W. (2002). Re-representing consciousness: dissociations between experience and meta-consciousness. *Trends in Cognitive Sciences*, 6 (8), 339-344.
- Shin, Y. K., Proctor, R. W., & Capaldi, E. J. (2010). A review of contemporary ideomotor theory. *Psychological Bulletin*, 136 (6), 943-974.
- Smith, E. R., & Lerner, M. (1986). Development of automatism of social judgments. *Journal of Personality and Social Psychology*, 50 (2), 246-259.
- Snyder, C. R., & Fromkin, H. L. (1977). Abnormality as a positive characteristic: The development and validation of a scale measuring need for uniqueness. *Journal of Abnormal Psychology*, 86, 518-527.
- Spengler, S., von Cramon, Y. D., & Brass, M. (2010). Resisting motor mimicry: Control of imitation involves processes central to social cognition in patients with frontal and temporo-parietal lesions. *Social Neuroscience*, 5 (4) 401-416.
- Stel, M., Blascovich, J., McCall, C., Mastop, J., van Baaren, R. B., & Vonk, R. (2009). Mimicking disliked others: Effects of *a priori* liking on the mimicry-liking link. *European Journal of Social Psychology*, 40 (5), 867-880.

- Stel, M., Rispens, S., Leliveld, M., & Lokhorst, A. (2011). The consequences of mimicry for prosocials and proselves: Effects of social value orientation on the mimicry-liking link. *European Journal of Social Psychology, 41*, 269-274.
- Stel, M., van Dijk, E., & Olivier, E. (2010). You want to know the truth? Then Don't Mimic. *Psychological Science, 20* (6), 693-699.
- Strahan, E. J., Spencer, S. J., & Zanna, M. P. (2002). Subliminal priming and persuasion: Striking while the iron is hot. *Journal of Experimental Social Psychology, 38* (6), 556-568.
- Sturmer, B., Aschersleben, G., & Prinz, W. (2000). Correspondence effects with manual gestures and postures: A study of imitation. *Journal of Experimental Psychology: Human Perception and Performance, 26* (6), 1746-1759.
- Tanner, R. J., Ferraro, R., Chartrand, T. L., Bettman, J. R., & van Baaren, R. (2008). Of chameleons and consumption: The impact of mimicry on choice and preferences. *Journal of Consumer Research, 34*, 754-766.
- Tzelgov, J. (1999). Automaticity and processing without awareness. *PSYCHE, 5* (3).
- Upton, G., & Cook, I. (2008). *A Dictionary of Statistics* (2nd ed. revised). Oxford: University Press, Oxford.
- van Baaren, R. B., Fockenberg, D. A., Holland, R. W., Janssen, L., & van Knippenberg, A. (2006). The moody chameleon: The effect of mood on non-conscious mimicry. *Social Cognition, 24* (4), 426-437.
- van Baaren, R. B., Holland, R. W., Kawakami, K., & van Knippenberg, A. (2004b). Mimicry and prosocial behavior. *Psychological Science, 15* (1), 71-74.
- van Baaren, R. B., Holland, R. W., Steenaert, B., & van Knippenberg, A. (2003a). Mimicry for money: Behavioral consequences of imitation. *Journal of Experimental Social Psychology, 39* (4), 393-398.
- van Baaren, R. B., Horgan, T. G., Chartrand, T. L., & Dijkmans, M. (2004a). The forest, the trees, and the chameleon: Context dependence and mimicry. *Journal of Personality and Social Psychology, 86* (3), 453-459.
- van Baaren, R., Janssen, L., Chartrand, T. L., & Dijksterhuis, A. (2009). Where is the love? The social aspects of mimicry. *Philosophical Transactions of the Royal Society of Biological Sciences, 364*, 2381-2389.
- van Baaren, R. B., Maddux, W., Chartrand, T., Bouter, C., & van Knippenberg, A. (2003b). It takes two to mimic: Behavioral consequences of self-construals. *Journal of Personality and Social Psychology, 84* (5), 1093-1102.
- van Knippenberg, A., Dijksterhuis, A., & Vermeulen, D. (1999). Judgement and memory of a criminal act: The effects of stereotypes and cognitive load. *European Journal of Social Psychology, 29*, 191-201.

- van Leeuwen, M. L., van Baaren, R. B., Martin, D., Dijksterhuis, A., & Bekkering, H. (2009). Executive functioning and imitation: Increasing working memory load facilitates behavioural imitation. *Neuropsychologia*, *47* (14), 3265-3270.
- van Schie, H. T., van Waterschoot, B. M., & Bekkering, H. (2008). Understanding action beyond imitation: Reversed compatibility effects of action observation in imitation and joint action. *Journal of Experimental Psychology: Human perception and Performance*, *34* (6), 1493-1500.
- van Swol, L. M. (2003). The effects of nonverbal mirroring on perceived persuasiveness, agreement with an imitator, and reciprocity in a group discussion. *Communication Research*, *30* (4), 461-480.
- Vrijesen, J. N., Lange, W., Becker, E. N., & Rinck, M. (2010). Socially anxious individuals lack unintentional mimicry. *Behaviour Research and Therapy*, *48* (6), 561-564.
- Vrijesen, J. N., Lange, W., Dotsch, R., Wigboldus, D. H. J., & Rinck, M. (2009). How do socially anxious women evaluate mimicry? A virtual reality study. *Cognition & Emotion*, *24* (5), 840-847.
- Wallace, R. J. (1972). Spatial S-R compatibility: Effects involving kinesthetic cues. *Journal of Experimental Psychology*, *93* (1), 163-168.
- Webb, O. J., Eves, F. F., & Smith, L. (2011). Investigating behavioural mimicry in the context of stair/escalator choice. *British Journal of Health Psychology*, *16*, 373-385.
- Wheeler, S. C., & Berger, J. (2007). When the same prime leads to different effects. *Journal of Consumer Research*, *34*, 357-368.
- Wheeler, S. C., & DeMarree, K. G. (2009). Multiple mechanisms of prime-to-behavior effects. *Social and Personality Psychology Compass*, *3/4*, 566-581.
- Wheatley, T. P., & Wegner, D. M. (2001). Automaticity in action. In N. J. Smelser & P. B. Baltes (Eds.), *International encyclopaedia of the social and behavioral sciences* (pp. 991-3). London: Pergamon.
- Wheaton, K.J., Thompson, J.C., Syngeniotis, A., Abbott, D.F., & Puce, A. (2004). Viewing the motion of human body parts activates different regions of premotor, temporal, and parietal cortex. *NeuroImage* *22*, 277-288.
- Wilson, M. (2001). Perceiving imitable stimuli: Consequences of isomorphism between input and output. *Psychological Bulletin*, *127* (4), 543-553.
- Wilson, T. D., & Dunn, E. (2004). Self-knowledge: Its limits, value, and potential for improvement. *Annual Review of Psychology*, *55*, 493-518.
- Woodside, A.G. (2006). Overcoming the illusion of will and self-fabrication: Going beyond naive subjective personal introspection to an unconscious/conscious theory of behavior explanation. *Psychology & Marketing*, *23* (3), 257-272.

- Wuf, G., McNevin, N., & Shea, C. H. (2001). The automaticity of complex motor skill learning as a function of attentional focus. *The Quarterly Journal of Experimental Psychology*, 54A (4), 1143-1154.
- Yabar, Y., Johnston, L., Miles, L., & Peace, V. (2006). Implicit behavioral mimicry: Investigating the impact of group membership. *Journal of Nonverbal Behavior*, 30 (3), 97-113.

Appendices

Appendix 1 – Gesture Pilot Questionnaire

Please rate how often you perform these gestures on an average day:

Rub your cheek(s)

Rarely 1 2 3 4 5 6 7 **Very Often**

Rub your forehead

Rarely 1 2 3 4 5 6 7 **Very Often**

Rub your nose

Rarely 1 2 3 4 5 6 7 **Very Often**

Rest your chin on your hand

Rarely 1 2 3 4 5 6 7 **Very Often**

Purse your lips

(pressing or pulling your bottom lip with your top lip)

Rarely 1 2 3 4 5 6 7 **Very Often**

Rub your neck

Rarely 1 2 3 4 5 6 7 **Very Often**

Touch your hair

Rarely 1 2 3 4 5 6 7 **Very Often**

Tuck your hair behind your ear

Rarely 1 2 3 4 5 6 7 **Very Often**

Play with your earrings or ear lobe

Rarely 1 2 3 4 5 6 7 **Very Often**

Cross your arms across your chest

Rarely 1 2 3 4 5 6 7 **Very Often**

Scratch the trunk of your body (back, abdomen)

Rarely 1 2 3 4 5 6 7 **Very Often**

Play with objects placed in front of you (pen, paperclip, etc.)

Rarely 1 2 3 4 5 6 7 **Very Often**

Shake or tap your foot

Rarely 1 2 3 4 5 6 7 **Very Often**

Bounce your knee up and down

Rarely 1 2 3 4 5 6 7 **Very Often**

Cross your legs

Rarely 1 2 3 4 5 6 7 **Very Often**

Appendix 2 – Actor’s ‘day in the life’ stories in the stimulus videos

Story one

The first thing I always do before I sit down at my desk, is make a cup of tea in my favourite yellow mug. It’s chipped, and old, but I just can’t bring myself to throw it away. Only then can I sit down at my desk, and get on with some work. At some point, I’m bound to be interrupted by my mobile going off. It’s almost always my good mate catching up, or asking to get together to grab some lunch. Luckily, I always have a stack of yellow post-it notes handy. Otherwise I would forget all my appointments because of my terrible diary keeping! After rummaging around in my desk drawer, I finally found a blue pen. The cap has long been chewed and lost, but it still works, so I scribble down the time my mate and I plan to meet up. That done, I can get back to work. Digging around in my cluttered bag, I find several notes and loose bits of paper crumpled up at the bottom. After getting all that organised, I grab a black stapler off my shelf, and staple together different bits of paper. Shuffling through all that, I find my final essay, which is due tomorrow. I put it in a bright green folder, so that I’m certain to see it and remember to bring it in. Getting everything sorted, I can get down to the boring task of reading two chapters in my psychology book, for my lecture later in the afternoon.

Story two

The other day I had to spend ages in the library to finish a poster project. As always, I had my MP3 player with me to help pass the time. Sadly, I had forgotten to charge the battery, and it died half way through my favourite song. Tossing it aside, I started digging through my old pencil case, which has got covered with ink stains over the years. Finally, I found a glue stick at the bottom of the case, and took it out to finish sticking the last graph on my poster. When I’d finished that, I could finally start gathering the rest of my things to leave. I picked up several notes I’d printed out and got a small hole-puncher out of my bag. With a loud squeak, that made loads of people in the library turn around, I punched holes in several stacks of paper. Grabbing my blue notebook from the corner of the table, I was able to put away the last of my work. As I was so glad to be finished, I quickly rolled up my poster. But in the process I knocked over my bottle of water. Thankfully it was empty, so I just picked it up, and chucked it in the rubbish bin nearby. I gathered up the rest of my stuff, and packed it into my bag. And with a bit of scrabbling around I found my keys. After one last check to make sure I got everything, I could finally leave the library.

Appendix 3 – Funnelled debrief awareness check

Feedback Questionnaire

We would be grateful if you would complete a few final questions about this study.

1. What do you think the purpose of this experiment was?

2. Did you think that any of the tasks you did were related in anyway?
(If “yes”) In what way were they related?

3. Were you aware that anything you did on one task affected what you did on any other task? (If “yes”) How do you think it affected you?

4. When you were watching the two videos, did you notice anything unusual about the person presenting the stories?

5. Did you notice any particular pattern or theme of the behaviour shown by the person in the video?

6. Did you notice any differences in the person’s behaviour across the two videos?

Please could you tell us your:

Gender: _____

Nationality: _____

Age: _____

Year of study:

1

2

3

Other _____

Appendix 4 - Actor's photo-description in the stimulus videos

Photograph one

This picture shows a very small town with snow on the ground, probably somewhere that has cold winters. It looks like the picture was taken from above. Maybe from an airplane or on top of a big peak. There are about, um, 12 or 14 houses spread along a small winding road. Uh, it is a quiet town. I can't see any people or cars on the 2 or 3 roads. But it does look like the sun is just coming up, ...or just setting because everything has that pretty orange glow from the sun being low on the horizon. So maybe it is really early in the morning and no one's out yet. It looks like the town is on an island or on the coast. Some of the houses are right on the water. A few of them even have little docks attached, so maybe it is a fishing community. There aren't really any boats tied up to the docks. But I guess that makes sense if the sun is just coming up. The fisherman would probably go out really early. It must be January or February as there is a good amount of snow on the ground. One of the houses even has smoke coming out of the chimney... And the sea around it looks really cold, but calm. There aren't really any waves hitting the coast line so maybe it is not too windy or the little town is protected in a bay. There are a few islands in the background. One is really close to the little town, it might even be connected. But there are no buildings or houses on it, just snow. Um, farther out there is a long chain of islands. But these also look like there are no houses on them. Hmm, there's a fog or mist hanging just over the islands and the water in the background.

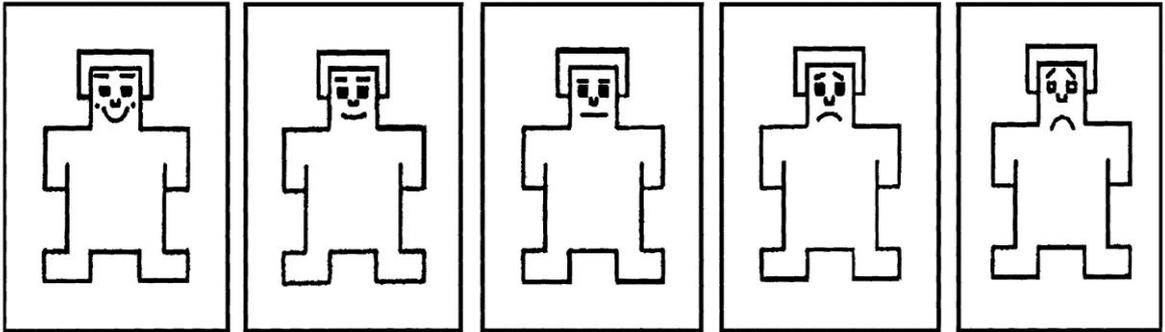
Photograph two

In this picture there is a scuba diver on an ocean floor. He's in full gear, with a blue and black wetsuit, red goggles, and an air tank. Umm, he also has lots of little gadgets on him. Things like dials, and hoses, and what looks kind of like a flash light...and a big watch looking thing. I guess you would need all of those high tech things for safety while your scuba diving. You know, to make sure you have enough oxygen or don't go too deep. He is kneeling on a sandy ocean floor and is holding up some kind of bottle... or can that has a big red cloud of stuff coming out of it...Maybe dust or dye. So..., I bet he is a scientist or something like that. Maybe he is testing for things in the water like chemicals...or maybe the red cloud helps to see microscopic animals in the water. But it does look like he's pretty deep. His wetsuit has the long sleeves and he has a hood thing over his head. So it could be really cold if he is way down below the surface of the water... And there is a light from a torch just behind him so you can see what he is doing, but beyond that it is pretty

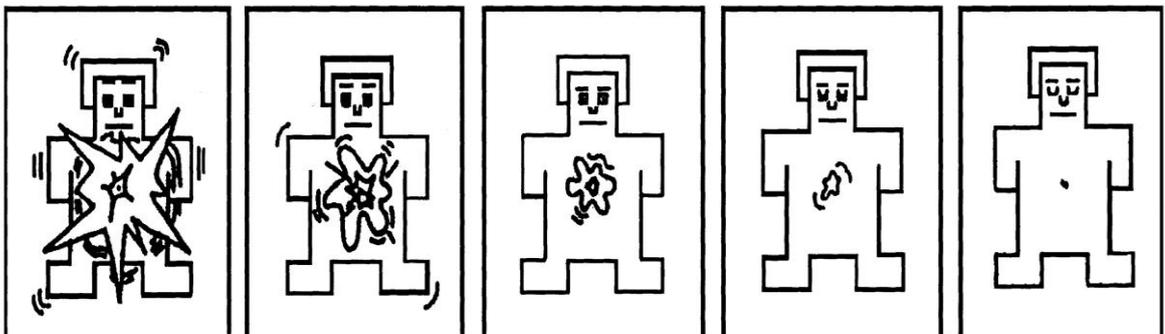
dark, and you can't really see anything. There is also a huge boulder of coral behind him...but no fish or plants or anything attached to it. And the water looks really clear. So maybe he is in the Caribbean...or Australia. I'm pretty sure there is lots of coral there and the water is really clear.

Appendix 5 - SAM Measure

*Please place a check under one manikin to describe how happy/satisfied to
unhappy/unsatisfied you feel at this time.*



*Please place a check under one manikin to describe how stimulated/excited to
relaxed/calm you feel at this time.*



Appendix 6 – Perception of the actor questionnaire

Please circle one answer for each question

1) Was the video clip easy to understand?

Not at all 1 2 3 4 5 6 7 Very Much

2) How would you rate the mood of the person in the video?

Very 1 2 3 4 5 6 7 Very Happy

3) Did you like the person you saw in the video?

Not at all 1 2 3 4 5 6 7 Very Much

Appendix 7 – Self-reported expression of behaviour questionnaire

Please estimate and write down the number of times you think you performed each mannerism during the video and your photo description

Crossed your arms across your chest: _____

Rested your chin on your hand: _____

Touched your hair: _____

Crossed your legs: _____

Touched your face: _____

Shook or tapped your foot: _____

Scratched your nose: _____

Bounced your knee up and down: _____

Appendix 8 – Funnelled debrief awareness check for Experiment 6

1) What do you think this study was about?

2) Have you ever taken part in a similar photo-description study in the psychology department?

Yes

No

3) Were you suspicious at any point that the study was looking at something other than what was stated?

Not at all

A little

A lot

4) Did you notice anything unusual during the study? If so, what?

5) Did you find that the person in the video seemed distracted or restless?

Not at all

1

2

3

4

5

6

7

Very much

6) Did you think there was a relationship between the video you watched and the photo-description task you completed? If so, what?

7) Please rate how much you agree or disagree with the following statements:

During the video I was aware the actor was fidgeting

Strongly disagree

1

2

3

4

5

6

7

Strongly agree

During the video and my own photo-description I tried not to fidget

Strongly disagree

1

2

3

4

5

6

7

Strongly agree

Please could you tell us your:

Gender: _____

Nationality: _____

Age: _____

Subject studied _____