

The neuroscience of gender bias within organisations:  
implicit and explicit influences.

by

James Wicks

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## **Abstract**

It has been 30 years since the metaphor of a ‘glass ceiling’ was introduced, yet progress to address gender bias in organisations has been slow. Within a context in which employment is rapidly changing and technologies are enabling new ways of working, gender bias in organisations remains a persistent and complex issue that requires new ways of thinking. This study integrates across two scientific disciplines: social cognitive neuroscience and complex adaptive systems, in order to examine the complex nature of gender bias in organisations and advance implications for practice.

The central proposition underlying this study is that the gender composition of a person’s ‘in-group’, that is the group of people one most closely relates to in a work setting, has implications for their level of gender bias. The relationship between in-group composition and gender bias is examined from implicit (unconscious) and explicit (conscious) bias perspectives. The composition of in-group is measured by homogeneity, size and trust, and is captured within an integrated instrument that includes measures of implicit and explicit bias.

The study is informed by the theory of interactive person construal. It is proposed that biases are a dynamic, continuously evolving phenomena emerging from top down and bottom up cues. Specifically, the essence of this research is the relationship between the neuroscientific dynamics of in-group and out-group differentiation within the human brain and the complex systemic nature of the modern workplace. The study endeavours to make a contribution to the understanding of how people who share common values and interests (in-group) influence gender bias in organisations.

The research has been conducted in a professional services organisation. A group of people within the organisation were asked to participate in an online survey to capture implicit bias, explicit bias, composition of their in-group and demographic details. This research applied a quantitative survey methodology.

The aims of the study are to:

- examine the relationship between in-group composition and gender bias building from theoretical insights from neuroscience and complex adaptive systems theory,
- test both implicit and explicit attitudes towards gender bias,
- test the relationship between implicit and explicit measures of bias, and
- provide a contribution to theory and practice in relation to addressing the issue of gender bias in organisations.

It is concluded that there is a statistically significant association between in-group composition and the manifestation of implicit and explicit bias using a variety of measures. The model of in-group composition developed for this study could be used as a means to understand gender system dynamics. A dynamic systems model of bias is proposed based on the research variables and complexity ideas examined in the study. For organisations, this research has implications for how the issue of gender bias should be approached. Connecting ideas from social cognitive neuroscience and complex adaptive systems, this research highlights the interrelationship between recurring levels (neural, individual, group, organisation) within the bias system and the nature of interventions that may lead to enduring change.

## Table of Contents

<b>1</b>	<b>Introduction.....</b>	<b>1</b>
1.1	The imperative for change.....	1
1.2	Focus of the research .....	2
1.3	Personal perspectives on this research .....	3
1.4	Theoretical foundations and research questions .....	3
<b>2</b>	<b>Literature review.....</b>	<b>6</b>
2.1	Bias literature .....	7
2.1.1	Gender bias.....	10
2.1.2	Gender bias in organisations.....	11
2.2	Social cognitive neuroscience.....	15
2.3	Complex adaptive systems.....	21
2.4	Literature review summary .....	23
<b>3</b>	<b>Theoretical foundations .....</b>	<b>24</b>
3.1	Research model .....	26
3.1.1	Defining the constructs in the research model.....	27
3.2	Research hypotheses .....	29
3.2.1	H1. In-group composition in relation to the IAT D score .....	30
3.2.2	H2. In-group composition in relation to explicit bias .....	31
3.2.3	H3. Implicit bias measure (IAT D score) in relation to explicit bias measures.....	32
<b>4</b>	<b>Research methodology .....</b>	<b>33</b>
4.1	Research design.....	33
4.1.1	Research approach.....	33
4.1.2	The research site.....	33
4.1.3	Sampling plan.....	34
4.1.4	Data collection .....	35
4.1.5	Response rates and respondent demographics .....	36
4.2	Instrumentation .....	36
4.2.1	Operationalising in-group composition.....	36
4.2.2	Operationalising explicit bias .....	37
4.2.3	Operationalising implicit bias .....	40
4.2.4	Relationship between explicit and implicit measures of bias .....	41
4.2.5	Control variables.....	43
4.2.6	Operationalising summary .....	43

4.3	Data file accuracy and screening .....	44
4.4	Data analysis plan .....	46
5	Analyses and results .....	47
5.1	Validity and reliability .....	47
5.2	Testing for scale reliability.....	47
5.3	Descriptive statistics.....	49
5.4	Testing for null hypothesis .....	51
5.4.1	Change in sample configuration.....	52
5.5	Detailed data analysis and results .....	56
5.5.1	H1. In-group composition in relation to the IAT D score .....	56
5.5.2	H2. In-group composition in relation to explicit bias .....	57
5.5.3	H3. Implicit bias measure (IAT D score) in relation to explicit bias measures.....	59
5.5.4	Supplementary analyses – explicit bias associations and multiple regression .....	59
6	Discussion .....	66
6.1	General observations.....	66
6.2	In group composition and gender bias .....	67
6.3	Relationships between bias scales.....	69
6.4	Complex adaptive systems.....	70
7	Conclusions.....	73
7.1	Research implications .....	73
7.2	Implications for practice .....	75
7.3	Limitations .....	78
7.4	Avenues for future research.....	78
	References .....	80
	Appendix 1: Survey design encoding of variables .....	94
	Coding table .....	95
	Coding confirmation: Project Implicit .....	102
	Appendix 2: Research information sheet and distribution email.....	114
	Research information sheet.....	114
	Distribution email .....	117
	Appendix 3: Implicit association test.....	119
	Appendix 4: Pilot study .....	121

# 1 Introduction

The aim of this study is to enhance understanding of gender bias in the workplace. Despite the salient metaphor of a *glass ceiling* being nearly 30 years old (Morrison, White & Van Velsor, 1987) progress to address gender bias within organisations has been slow (Bendl & Schmidt 2010; Eagly & Carli, 2007; Matsa & Miller, 2011). Opportunities to create enhanced gender equality have not been grasped despite significant changes in the way work is organised in response to advances in technology, globalisation, and virtualisation. There is some evidence of progress to address gender bias (Elsesser & Lever, 2011). Closer examination shows that much of this can be attributed to women in stereotypical gender roles (Richeson & Ambady, 2001). In New Zealand (McPherson, 2010) and Australia (Whelan & Wood, 2012) the trends are similar.

## 1.1 The imperative for change

The percentage of women graduating from university and participating in the labour force has reached similar levels to men in many countries, including New Zealand and Australia (McPherson, 2010; Whelan & Wood, 2012). Yet, as a human resource, this segment of society is not being effectively utilised. There are both economic and moral imperatives that suggest that greater research attention is required to address the issue of gender bias in the workplace.

First, from an economic perspective, Whelan & Wood (2012) have shown that greater utilisation of women leads to improved decision-making, new ideas, a wider talent pool, and increased productivity. For example, in Australia closing the gender gap would boost GDP by 11% (Whelan & Wood, 2012).

The literature examining the relationship between financial performance and more women in positions of power in organisations presents an inconclusive picture (Haslam, Ryan, Kulich, Trojanowski & Atkins, 2010; Judge & Livingston, 2008; Ryan & Haslam, 2005; Ryan, Haslam & Postmes 2007). On the one hand, there are those who make definite statements, for example: “the underemployment and underutilisation has been costly for nations and organisations alike” (Whelan & Wood, 2012, p. 4). On the other hand, Haslam and colleagues, (2010) re-examine past studies and methods and conclude that objective measures of financial performance

may not be affected by the presence of more women in senior roles, but subjectively driven measures, such as stock performance, may be negatively affected. This suggests prevalent gender bias and reinforces the notion of the ‘glass cliff’ (Ryan, Haslam, Hersby, & Bongiorno, 2011; Ryan et al., 2007). An example to illustrate the glass cliff is the appointment of women to high risk positions, then being put under more scrutiny than their male peers by both men and women, effectively setting them up to fail (Haynes & Heilman, 2013).

Second, from a moral perspective, equity is a value often espoused by organisations. The moral reasoning is simple to express but, like economic drivers, exemplifies complexity. Gender roles are evolving and as a result organisations are endeavouring to be fair and equitable in the way they recognise and promote their people (Genat, Wood, & Sojo, 2012). However, fair and equitable can have many meanings. Moral judgements and behaviours emerge from social contexts and social relationships. “The moral status of actions cannot be determined independent of the social-relational context in which they take place.” (Rai & Fiske, 2011, p. 57). In organisations, social relationships are within the context of prevailing norms, beliefs, and in-group biases. How individuals respond to these explicit and implicit factors can create contradictions between the espoused moral reasons for addressing gender bias and what emerges as behaviour. A lack of attention being paid to the implicit nature of bias is one of the reasons change efforts in this area have been stymied (Whelan & Wood, 2012).

## **1.2 Focus of the research**

In this study, the neuroscience of bias is examined focusing on gender bias in organisations, including implicit (unconscious) and explicit (conscious) bias, as well as ‘in-group/out-group’ social influences. The study endeavours to contribute to understanding how people who share common values and interests (in-group) influence gender bias in organisations. White male managers are an example of a manifest in-group in an organisation where managers tend to be male. Female managers, when compared with male managers in the same organisation, are an example of an out-group. In addition, influences relating to complex adaptive systems are considered and linkages between the nature of systems and bias are explored. The complexity lens attempts to shed some light on why gender bias in organisations appears to be difficult to address.



The research has been conducted in a professional services organisation. A group of people within the organisation were asked to participate in a series of online surveys to capture implicit bias, explicit bias, composition of their in-group and demographic details. This research applied a quantitative survey methodology the details of which are explained in Chapter Four.

### **1.3 Personal perspectives on this research**

The intractable nature of gender bias in organisations has been confirmed by the researcher's own experience. In the 1990s, I was part of a change programme in an iconic New Zealand Bank that had fallen on hard times. The new chief executive believed that people would be the differentiating factor in the future. In the course of researching case studies, literature reviews and internal analyses, the impacts of gender bias surfaced as a barrier to people progressing in the organisation and even being attracted to work in the organisation. This sparked my curiosity about a topic of which I had been largely unaware. My current interest in this topic is from both research and practice perspectives. It is based on frustration that gender bias as an issue remains alive and well. The frustration stems from a belief that organisations should be places that enable all people to grow and develop. Adding to the frustration is an observation that complex problems (such as gender bias) continue to be approached in ways not suited to the dynamics of complexity. By integrating theoretical propositions and research insights from neuroscience and complex adaptive systems, it is proposed that novel perspectives will emerge with the potential to advance the understanding of the recalcitrant issue.

### **1.4 Theoretical foundations and research questions**

For the purposes of this study, research foundations from two scientific disciplines will be applied. First, gender bias are examined from the perspective of social cognitive neuroscience (Lieberman, 2012; Ochsner & Lieberman, 2001), which manifests in the emerging organisational cognitive neuroscience field (Butler & Senior, 2007; McDonald & Tang, 2014). Second, complex adaptive systems theory (Holland, 2006; McDaniel 2007) is used to examine the complex nature of gender bias and inform implications for practice.

The key research question is:

*To what extent does the composition of in-group associate with gender bias?*

In exploring the research question, the following sub-questions are considered:

- *To what extent does the composition of in-group associate with implicit (unconscious) gender bias?*
- *To what extent does the composition of in-group associate with explicit (conscious) gender bias?*
- *How can complex adaptive systems inform understanding of gender bias?*

The central proposition underlying this research is that the gender composition of a person's in-group, that is, the group of people a person most closely relates to, has implications for their level of gender bias. The essence of this research is the relationship between the neuroscientific dynamics of in-group and out-group differentiation in the human brain and the complex systemic nature of the modern workplace. This relationship is examined from the perspectives of both implicit (unconscious) and explicit (conscious) bias. Implications for practice in organisations are considered through a complex adaptive systems lens.

The aims of this study are to:

- examine the relationship between in-group composition and gender bias using theoretical insights from neuroscience and complex adaptive systems theory,
- test both implicit and explicit attitudes towards gender bias, and
- provide a contribution to theory and practice in relation to addressing gender bias.

In addressing these questions this study aims to contribute to research by:

1. adding to existing knowledge of in-group composition as a construct of gender bias,
2. providing insight to the relationship between in-group composition and implicit gender bias,
3. providing insight to the relationship between in-group composition and explicit bias,
4. adding to the knowledge of the interrelationship between implicit and explicit gender bias,
5. adding to the knowledge of how thinking tools from complexity science can inform approaches to understanding and addressing gender bias, and

6. contributing to practice by using complex adaptive systems theory to provide insights into how organisational systems could be redesigned.

This thesis advances as follows:

- Chapter Two provides a review of the current literature from three domains of research. First, the literature relating to bias in general is examined with specific focus on gender bias. Second, the literature of neuroscience is discussed, including a discussion of in-group and out-group dynamics within the brain. Third, complex adaptive systems (CAS) are discussed to address in a comprehensive manner the ways in which bias manifests in the modern workplace.
- Chapter Three presents the theoretical foundations of the research and hypotheses. The theoretical rationale for exploring the relationship between in-group composition and gender bias through a complex adaptive systems lens is provided by the dynamic interactive theory of person construal (Freeman & Ambady, 2011).
- Chapter Four describes the methodology used. This research applies a quantitative survey approach. The design incorporates multiple implicit and explicit bias measures. Data for the measures is captured online together with the composition of respondents' in-groups.
- Chapter Five presents the findings from a statistical analysis of the data. For each hypothesis, statistical evidence is presented that either confirms or rejects the hypothesis.
- Chapter Six provides a discussion and analysis of the findings by contrasting this study with the literature reviewed in Chapter Two. A systemic model of gender bias is proposed as part of the discussion.
- Chapter Seven revisits the original research questions and presents conclusions and recommendations for future study and practice.

## 2 Literature review

The theoretical foundations for this research are the relationship between the neuroscientific dynamics of in-group and out-group differentiation and the complex nature of the modern workplace. Three bodies of theory form the foundations of the literature review. First, the literature relating to bias in general is examined with the focus narrowing to consider gender bias specifically. Second, the literature of neuroscience is discussed including a discussion on in-group and out-group, and neurological processes in the brain. Third, complex adaptive systems are discussed to comprehensively address how bias manifests in the modern workplace.

This research starts out reviewing the literature on bias with particular emphasis on gender bias. A key finding in the literature is that although gender bias in the modern workplace is rooted in human cognition, in terms of explicit bias conscious to the individual, implicit bias, which operates below the level of human consciousness, is also a critical consideration (Bobula, 2011).

Recent findings from neuroscience research offer novel insights into the nature of implicit bias. Key findings from the neuroscience literature are introduced in this chapter to add depth and novel perspectives relative to the traditional bias literature emanating from cognitive psychology. The literature on bias suggests that bias is a multi-dimensional phenomenon that manifests as a function of individual, organisational, and social dynamics within interconnected networks (Freeman & Ambady, 2011; Hogue & Lord, 2007). Therefore, to understand the phenomenon of bias in the modern workplace, a meso-level approach is warranted that spans levels of analysis and theoretical perspectives. To this end, the literature on complex adaptive systems is relevant to the research question as a way of making sense of the multiple constructs (implicit bias, explicit bias, in-group, and out-group) included in the research.

Social cognitive neuroscience (SCN) and complex adaptive systems (CAS) provide complementary theoretical bases for bias research. Concepts evident in SCN, such as the dynamic connectionist nature of networks in the brain, interrelationships between individuals and groups, and bias as an emergent property, are consistent with CAS principles.

The CAS literature provides an alternative lens through which to explore why bias in organisations is a persistent issue. The complexity approach shifts the emphasis away from gender issues in organisations from ‘a gap to close’ to ‘a system to manage’. This may provide insight into why linear cause and effect approaches to gender bias provide unintended consequences and/or outcomes that cannot be sustained over the long term.

## 2.1 Bias literature

Biases are a cognitive phenomenon that enable humans to function within external contexts. It is normal for humans to categorise objects and people. The ability to do this quickly, often without knowing, enables people to navigate their context efficiently. Fiske (1998) confirmed that categorisation is a fundamental human tendency: “researchers now unanimously converge on the pervasive human propensity to categorise each other.” (Fiske, 1998, p. 364). The perceptions that we form of ourselves, others, and where we fit in, start at a young age and develop throughout life. These perceptions allow cognitive shortcuts that are evolutionary imperatives, for example: enabling quick differentiation between friend and foe. However, in the rapidly changing and complex contexts in which we now exist, some of these cognitive processes may not always serve us well. Therefore, it is important to understand bias, and the contribution research into bias can make to support human evolution in the complexity of the modern world.

Early researchers use various inter-related terms when discussing bias in the wider literature, including: stereotype, prejudice, discrimination, and bias. Fiske (1998) clarifies the relationship among these terms in the study of social psychology and explains that they all constitute bias at a cognitive (stereotyping), affective (prejudice), and behavioural (discrimination) level. Bias manifests from a reaction “to a person on the basis of perceived membership in a single human category, ignoring other category memberships and other personal attributes” (Fiske, 2002, p. 123).

Early research, circa 1940s, focused on reported bias, also referred to as explicit bias. This research stemmed from efforts to understand blatant forms of bias with a focus on the individual in a social setting exhibiting bias, for example, the holocaust or the behaviour of groups such as the Ku Klux Klan (Fiske, 1998). In these contexts it was common to capture overt expressions of bias. In the 1950s, researchers noticed a shift in what people were reporting as their biases but did not observe a shift

in actual behaviour. At that time, Allport's (1954) research introduced the concept that social categorisation was driven by context. The idea of categorisation was not seriously explored until the 1970s; meanwhile, new theories and labels emerged in the quest to understand the more subtle forms of bias. Various labels were summarised by Swim and colleagues (1995) under the general heading of 'modern racism'. With the emergence of women's rights into consciousness, similarities were observed between the nature of enduring racism and sexism (Swim, Aikin, Hall & Hunter, 1995).

Subsequent advances were from studies highlighting the automatic nature of bias, in-group and out-group categorisation, and the emerging field of social cognitive neuroscience (SCN). The phrase 'social cognitive neuroscience' was first introduced in *The Social Brain* (Gazzaniga, 1985) and was popularised by Cacioppo and Bernston (1992). These advances have led to studies in a range of different areas of interest to researchers, including:

- race (Meissner & Brigham, 2001; Phelps, et al., 2000),
- age (Blanchard-Fields & Horhota, 2006; Morrow, 2005),
- health (John-Henderson, Jacobs, Mendoza-Denton & Francis, 2013; Nazroo, 2003),
- education (Kao & Thompson, 2003; Molenaar & Chiu, 2014), and
- gender (Bendl & Schmidt, 2010; Whelan & Wood, 2012).

Much research has historically focused on the downstream impacts of categorisation; that is, how relatively high-level cognitive processes shape downstream behaviour and outcomes. An emerging area of research is endeavouring to understand how lower-level perception mechanisms, for example, facial processing, produce a social cognitive response (Freeman & Ambady, 2011). This research examines the categorisation process as well as the behavioural implications flowing from categorisation.

Research advances have also been facilitated by both the advent of technology that enables observation of brain processes (Lieberman, 2012) and methods that provide accessible measures of conscious (explicit) and unconscious (implicit) bias. For example, the implicit association test (Nosek, Hawkins & Frazier, 2011) is a computer based method that has led to greater understanding of implicit bias.

Explicit bias refers to the attitudes and beliefs that we have about a person or group on a conscious level. They are: the stereotypes that are deliberately thought

about and reported on (Greenwald & Banaji, 1995). Where it is socially acceptable we are more likely to express explicit bias. Explicit bias is processed with awareness and intent and is often accompanied by deliberate overt behaviour, including passive exclusion, or more direct acts such as physical or verbal harassment (Bobula, 2011). On the other hand, implicit bias operates at the unconscious level. Implicit bias is defined as: positive and negative evaluations that occur outside of our conscious awareness and control (Greenwald & Banaji, 1995). The focus of bias research has shifted to unconscious aspects of bias. Fiske (1998) recognised that bias endures in the face of changes to expressed views: “According to current wisdom, automatic categorisation and automatic associations to categories are the major culprits in the endurance of bias” (Fiske, 1998, p. 364).

Implicit biases enable quick decision making with minimal effort (Lieberman, Rock & Cox, 2014). These neurological dynamics can be helpful when navigating everyday life by quickly calling on past experience to inform decisions and actions. If we were to consciously process every aspect of everything we saw and interacted with as a unique experience we would be completely swamped (Freeman & Ambady, 2011). Biases also enable humans to navigate their social world from a young age (Dunham & Degner, 2010). Automatic processing may have served as a protection mechanism by enabling quick differentiation between friend and potential foe. Bias enables quick categorisation of objects on the basis that the consequences of mistaking a good object for a bad one are potentially far less than vice versa (Cunningham, Johnson, Gatenby, Gore & Banaji, 2003). However, implicit biases can be unhelpful if new information is not considered or potential options are ignored when making important decisions or dealing with complex issues (Lieberman et al., 2014). To make better decisions and deal with complexity it is therefore potentially useful to develop both awareness of biases and the ability to choose a response to biases.

There is debate as to the extent to which bias is fully formed in individuals by late adolescence and the potential for change later in life. On the one hand, there are studies that propose that biases exist fully formed from established neurological patterns from around age eighteen (Dunham & Degner, 2010; Kinzler, Shutts & Correll, 2010; Platten, Hernik, Fonagy & Fearon, 2010). On the other hand, constructive developmental theory (Berger, 2012; Cook-Greuter 2004; Kegan & Lahey, 2009; Torbert, 2004) suggests that awareness and perspective taking continues

to develop as adults move through developmental stages. Ongoing development is also supported by neuroscience approaches to understanding the brain (Kegan & Lahey, 2010). This means that people can shift from being held by their biases to holding their biases – a subject–object shift – shifting from being subject to automatic biases to holding those biases as object, building understanding of them and choosing a response. Torbert (2004) refers to this practice as “triple loop learning”.

Applying the notion of subject–object shift to gender bias is not explored directly in this study, however, strategies to address unconscious motivations described by constructive developmentalists support insights from neuroscience (Lieberman et al., 2014). Although awareness of self-concept changes as people develop as adults, and self-categorisation theory posits that in-group is an important part of the self-concept (Bosson & Michniewicz, 2013), the underlying neural processes relating to in-group are often reflexive, supporting the persistence of bias (Mitchell, Ames, Jenkins & Banaji, 2008). Little evidence was found in the literature of insights from constructive developmental theory and neuroscience fields converging in the research on gender bias. This maybe an area for future exploration.

### **2.1.1 Gender bias**

Several studies have demonstrated that gender dominates race, age and occupation as a bias (Barberá, 2003; Fiske, 1998). Ridgeway (2009) describes gender as a primary frame when humans are shaping their social relations, which supports the centrality of gender. In order to cognitively process our social relationships in real time, short cuts utilising past experience and knowledge are necessary. The categorisation of male or female is almost instant (Ito & Urland, 2003). Future information collected about the person, and future categorisation and interactions are then nested in the stereotypes that accompany the earlier gender categorisation (Ridgeway, 2009).

Gender categorisation is only part of the cognitive process. Another important aspect is what gender means both to the individual and collectively as a culture or group, from both descriptive and prescriptive perspectives (Elsesser & Lever, 2011). From an individual perspective, the classic approach to gender identity uses personality descriptions of agentic (competitive, aggressive) and communal (warm, tender) traits to describe male and female characteristics, respectively. A second approach is the self-categorisation approach that identifies with the category of men



or women (Wood & Eagly, 2012; Wood & Eagly, 2015). Researchers tend to use one or the other of these personality or categorisation options depending on the research question. The former focuses on agentic and communal behaviours and the latter focuses on group-level reactions. Multiple social categories and other dimensions of personality are not captured by these two approaches. Other constructs include the attitudes people hold towards men and women, traditional or egalitarian gender relations, personality traits, or beliefs about the traits of men and women (Wood & Eagly, 2012; Wood & Eagly, 2015).

In contemporary psychological science, it is now more accepted that on average women perceive communal behaviours, people-centred interests and vocations, and a collective identity as a woman as more rewarding (Wood & Eagly, 2015). In contrast, on average men perceive that agentic behaviours, thing-centred interests and vocations, and a collective identity as a man as more rewarding (Wood & Eagly, 2015). This self-knowledge, together with group identity, provides a guide to behaviour and the manifestation of gender bias. The implicit and explicit nature of gender bias, as described earlier, means that the constructs of gender bias discussed above may or may not be fully held at the level of conscious awareness (Whelan & Wood, 2012).

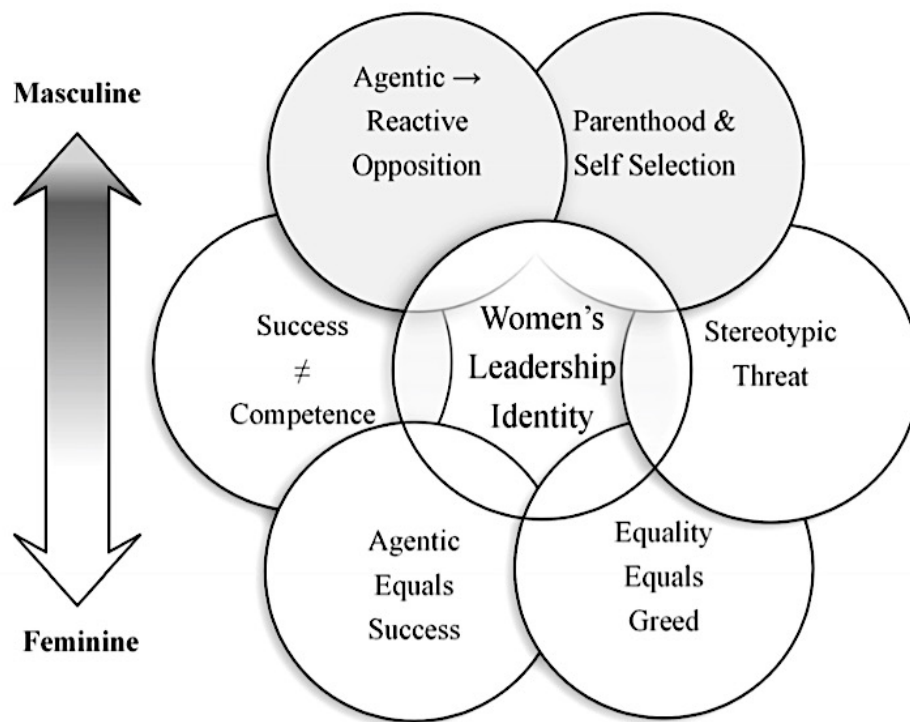
Building on the definition used to describe bias (Fiske, 1998), and the discussion so far, the following working definition of gender bias is used in this study: gender bias occurs when a person makes sense of another person or group in a gender stereotypical way leading to categorisation, decisions and behaviour based on the target's gender. This definition provides a starting point from which the discussion on gender bias in organisations can be presented.

### **2.1.2 Gender bias in organisations**

Gender bias in organisations goes beyond specific occupations and extends across sectors – private, public, and not-for-profit. Underlying themes include a lack of progress for women, pay inequity with men and low representation of women in leadership positions. Gender bias in organisations is conceptualised in the literature through a range of lenses and perspectives (Hogue & Lord, 2007). Theoretical foundations include: role congruity theory (Eagly & Karau, 2002; Elssesser & Lever, 2011), social role theory (Isaac, Kaatz & Carnes, 2012), managerial sex typing (Schein, 2001), acknowledging success and consequences of failure in non-

stereotypical roles (Heilman & Haynes 2005; Heilman & Okimoto, 2007); issues encoding leadership trait behaviour (Scott & Brown, 2006); structural influences (Morrison et al., 1987), and prescriptive and descriptive stereotypes (Heilman, Wallen, Fuchs & Tamkins, 2004). These theoretical variations exist against a backdrop of changing ways of working, moves away from traditional organisations and organisational structures, and emerging definitions of career (Bendl & Schmidt, 2010).

Implicit bias is one of the factors that contribute to continued discrimination against women in the workplace (Genat, et al., 2012). However, it is difficult to detect because of its subtle nature. It is pervasive because it is embedded in social norms and is often institutionalised in organisational systems and processes (Landy, 2008). Beliefs at the individual level, group norms, and organisational systems and processes shape interactions between people, creating recurring, self-reinforcing layers of discrimination from individual through to the organisational culture, which makes bias difficult to address (Genat et al., 2012). The underlying dynamics of bias and the difficult nature of addressing the issue at multiple layers (Hogue & Lord, 2007) is a contributor to slow progress since the ‘glass ceiling’ metaphor was introduced (Morrison et al., 1987). The framework of the glass ceiling (Figure 1) shows the relationship between women’s identity and implicit bias. At the centre is women’s leadership identity and around the outside are stereotypical expectations with the intersections indicating the barriers of implicit gender bias (Isaac et al., 2012).



*Figure 1. Framework of the glass ceiling (Isaac et al., 2012 p. 81)*

Figure 1 also shows that addressing gender bias based on a binary interpretation of bias is not helpful (e.g., right over wrong; men over women). It does not take into account the multi-faceted nature of the problem. Notions that agentic equals success and success doesn't equal competence are of particular interest and play out quite differently for men and women. A backlash effect has been shown to impact women in the way these factors play out. This effect includes lower performance ratings for the same work as men, stronger correlation between performance ratings and promotion than for men, alienation from one's own gender group and being seen by males as aggressive (Genat et al., 2012; Ryan & Haslam, 2005).

The literature highlights these effects throughout the employment lifecycle, reinforcing that gender bias is pervasive and persistent. Studies demonstrate effects in recruitment and promotion (Eagly & Carli, 2007), performance evaluation (Eagly & Karau, 2002; Lyness & Heilman, 2006), pay (Kolesnikova & Liu, 2011; Lips, 2013; Nadler & Stockdale, 2012) and career choices (Konrad, 2003). In their meta-analysis of experimental studies, Koch and colleagues (2015) focused on role congruity (Eagly

& Karau, 2002) for both men and women and found: “the greater incongruence between stereotypical gender traits and the gender stereotype of a job, the greater the gender bias, particularly for masculine jobs” (Koch, D’Mello and Sackett, 2015, p. 138). “Masculine jobs” are those dominated by males. Other findings in this study included male raters tending to favour males, and both male and female raters being pro-male for female dominated jobs. Less bias was exhibited when raters were experienced professionals and/or well trained. The authors highlight three important variables that impact bias: 1) rater gender, 2) content of the individuating information and 3) motivation and training to make careful decisions (Koch et al., 2015). These findings are reinforced by a similar Australian meta study (Genat et al., 2012) and consistent with organisational studies (e.g., Elsesser & Lever, 2011; Lyness & Heilman, 2006). An illustrative example of the effects of gender bias in organisations can be found in the legal profession (Glazebrook, 2014; Woodington, 2010), where a disproportionate number of men are represented in senior private practice roles and as judges. Whereas, women are better represented in corporate or government in-house legal roles (Glazebrook, 2014). This trend is consistent with findings from studies that highlight women gravitating towards senior staff roles in organisations rather than line roles (McPherson, 2010).

In summary, gender bias in organisations is a complex issue. It has persisted despite decades of initiatives intended to address gender bias. The conclusion is that many initiatives have not recognised the multiple dimensions that maintain the status quo or the implicit nature of gender bias. Gender bias in organisations is multi-layered (individual, group, team, organisation) and becomes embedded in the organisational culture through norms and systems. The complex web that gender bias presents reinforces the value of ideas from both social cognitive neuroscience and complex adaptive systems as lenses to explore the issue.

## 2.2 Social cognitive neuroscience

The idea that humans possess psychological processes as well as physical attributes can be traced back thousands of years<sup>1</sup>. For example, Galen, in ancient Greece, suggested that our social nature was influenced by four substances in our bodies called ‘humours’<sup>2</sup>. Fast forward to the 1860s, when the case of Phineas Gage generated insights to brain function. Gage survived an explosion that sent a tamping iron in one side of his brain and out the other, resulting in him retaining his motor skills but being a changed man socially. This case and others presented opportunities for study and helped to develop understanding of what parts of the brain may be engaged in different interactions, however, the number of subjects available limited the growth of research and development of a sustainable field.

The first suggestions of a possible new field of research can be traced back to a chapter on the brain bases of social psychology in Allport’s (1924) first text book. Decades later the field of social cognitive neuroscience actually began to emerge when *The Social Brain* (Gazzaniga, 1985) was published (Lieberman, 2012). Following this publication, advances by researchers in the early 1990s used primates to make observations relating to social cognition. Neurons were observed in the amygdala of primates in response to social stimuli (Brothers, Ring & Kling, 1990). About the same time neurons were also observed in the temporal sulcus of primates that responded to biological motion such as eye movement (Perrett et al., 1989). The notion that the human brain evolved to enable living in larger groups while keeping track of complex social relationships between group members was the next seminal piece of work flowing from work with primates (Dunbar, 1992). Mounting evidence supports this claim that the modern human brain has developed primarily for sociality rather than this being a secondary function of the cognitive system (Lieberman, 2012).

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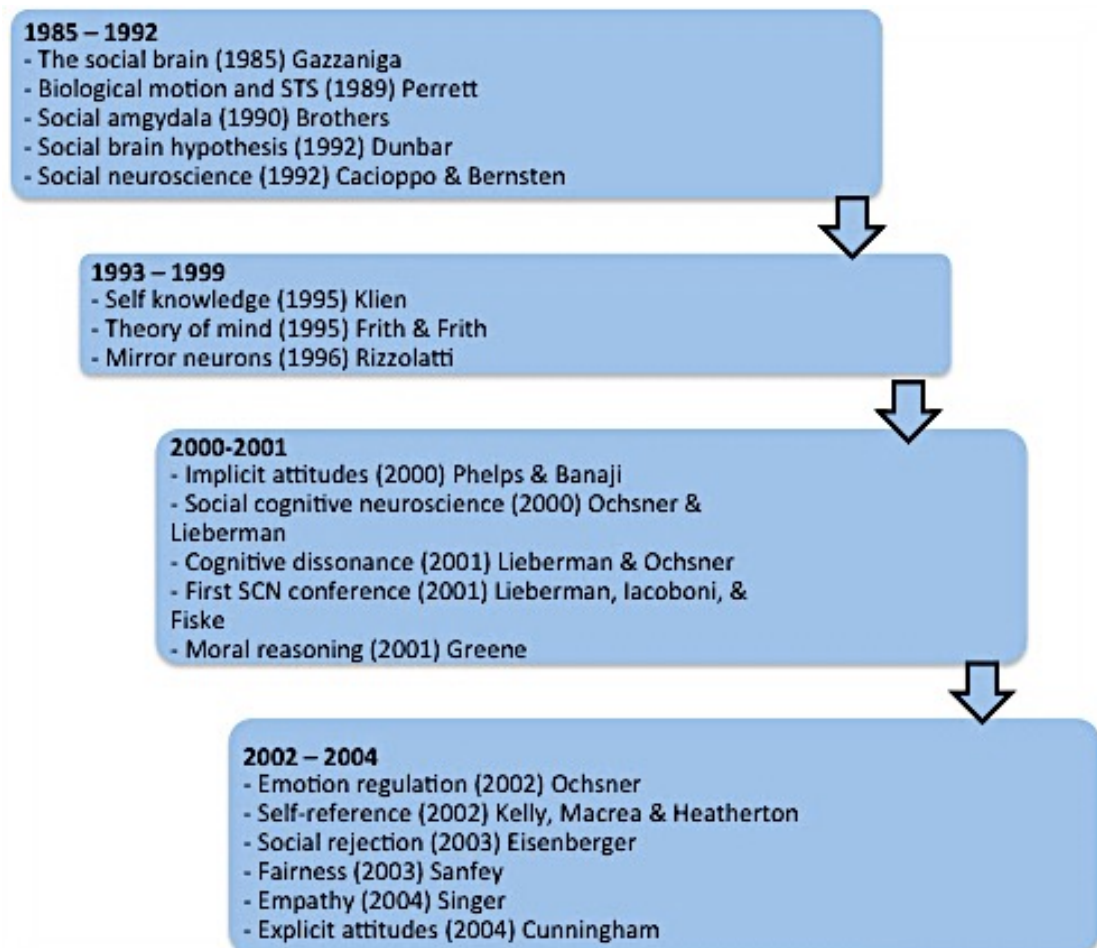
<sup>1</sup> The timeline outlined in this section is adapted from: *A geographical history of social cognitive neuroscience* (Lieberman, 2012).

<sup>2</sup> These four substances (blood, black bile, yellow bile and phlegm) were linked to personality styles (sanguine, melancholic, choleric and phlegmatic).

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<https://www.nlm.nih.gov/exhibition/shakespeare/fourhumors.html>

During the 1990s and beyond several key milestones occurred (Figure 2). Social psychologists and cognitive neuroscientists began collaborating more and more and in 2000 the term ‘social cognitive neuroscience’ first appeared in a journal dedicated to the topic.



*Figure 2.* Milestones in the evolution of SCN (adapted from Lieberman, 2012)

Social cognitive neuroscience (SCN) is a growing interdisciplinary field of research combining tools from cognitive neuroscience with theories from social sciences with the objective of understanding phenomena at three levels of analysis: the social level, the cognitive level and the neural level Lieberman (2007; Ochsner & Lieberman, 2001). Lieberman (2007, p.260) lists four themes used to capture the breadth of the area: “(a) understanding others, (b) understanding oneself, (c) controlling oneself and (d) the processes that occur at the interface of self and others”.

Over the last fifteen years, a coherent area of study has emerged, accelerated by advanced technologies such as functional magnetic resonance imaging (fMRI), positron emission tomography (PET), qualitative electro-encephalography (QEEG) and transcranial magnetic stimulation (TMS) (Butler & Senior, 2007; Lieberman, 2005). The potential of social cognitive neuroscience to address the issue of bias has been recognised in several journal special issues and studies, including: *Journal of Personality and Social Psychology* (2003), *Neuropsychologia* (2003), *Journal of Cognitive Neuroscience* (2003), *Neuroimage* (2005), *Brain Research* (2006), *Group Processes and Intergroup Relations* (2008) and *Neuroscience and Behavioural Reviews* (2013). However, few of these studies focus on the relationship between neurological dynamics as manifest in in-group composition while also considering the implications from a complex adaptive systems perspective.

Advances in techniques available to support research have enabled researchers to better understand neural relationships and cognitive activity within the brain. This research is being put to good use to better inform the study of implicit versus explicit bias. The relationship between explicit and implicit processes is unclear and they may be unrelated and independent of each other (Frith & Frith, 2008). Early research into the cognitive processes associated with bias identified brain activity in the amygdala leading to automatic and rapid response. This was associated with fear conditioning (Phillips & LeDoux, 1992) and negativity towards certain groups (Cunningham et al., 2003). Later work on prejudice has shown that other brain regions contribute to social evaluations. It has been noted that activity in the dorsolateral prefrontal cortex and anterior cingulate are associated with deliberate attempts to control undesirable responses (Frith & Frith, 2008).

A study that compared explicit and implicit measures of bias showed activity in the right frontal cortex reinforcing the notion that this region plays an important role in the application and suppression of stereotypical inferences (Mitchell et al., 2008). This right frontal activity has been associated with various functions including categorisation and semantic retrieval of categorical knowledge (Mitchell et al., 2008; Reber, Stark & Squire, 1998), response inhibition (Aron, Robbins, & Poldrack, 2004), assessment of emotional facial expressions (Nakamura et al., 1999), and self-perception (Lieberman, 2003). It was found in the study carried out by Mitchell and colleagues (2008) that the pattern of right frontal activation was strongest for those participants who measured the strongest stereotypical associations with gender.

Mitchell and colleagues (2008) propose that this may “represent the application of category knowledge in the service of social judgement” (Mitchell et al., 2008, p. 600).

A key concept in the literature relevant to this study is this human tendency for automatic categorisation and evaluation based on self-perception, stereotypes, and group membership (Cunningham & Zelazo, 2007; Mitchell et al., 2008) and how this may contribute to the enduring nature of gender bias. In early times the ability to recognise and be attracted to one’s in-group (usually a family group or small tribe) and discern differences between groups were likely to be useful attributes related to survival, collaboration and competition for scarce resources (Brewer, 1999). These cognitive processes may have evolved to be unconscious.

Although humans now tend to belong to many groups, our needs for acceptance, approval, connection, and being treated in a fair and trustworthy way remain strong and can create a series of contradictions when navigating multiple group relationships. Multiple group relationships require additional cognitive resources that may or may not be available in the moment. The multiplicity of group memberships may lead to greater social stability and tolerance (Brewer, 1999); however, the choices that a person makes about which group has priority at any one time is contextual. An illustration of the role of group membership is demonstrated by an experiment where in-group bias was identified in neural processing within minutes of people being assigned to teams (Van Bavel, Packer & Cunningham, 2008). In this example the team at that moment became the most salient group. This notion of salience is one of three determinates of in-group bias together with status and relevance (Bosson & Michniewicz, 2013). These factors and work on the idea of precarious manhood<sup>3</sup> (Bosson & Michniewicz, 2013; Bosson & Vandello, 2011) may combine to provide insight to the persistence of gender bias in the workplace.

Both individual psychological and social structures mean that in-group and out-group dynamics emerge. Attention paid to the in-group may be a core driver of bias: “many forms of discrimination and bias may develop not because out-groups are hated, but because positive emotions such as admiration, sympathy, and trust are reserved for the in-group and withheld from out-groups” (Brewer, 1999, p. 438).

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<sup>3</sup> The notion that men have status and identity at risk more so than women.



There is now neural evidence that in-group members are thought about in greater depth than out-group members (Van Bavel et al., 2008). An added dimension to categorisation is an established model of stereotyping that suggests that both group membership information, especially that which is obvious (age, race, gender), and individualising information together play a role when forming perceptions (Mitchell et al., 2008). A group membership-based approach to categorisation leads to bias (Fiske & Neuberg, 1990), whereas pausing to consider individual attributes may lead to a more nuanced assessment. Fiske (2002) suggests that bias is: “thus a narrow, potentially erroneous reaction, compared with individuated impressions formed from personal details” (Fiske, 2002, p.123).

Members of a dominant group will generally show higher levels of implicit in-group bias. Relevant to this study is the exception that the opposite dynamic occurs when categorising by gender. When males are the dominate group their level of implicit in-group bias reports at lower levels than for females (Greenwald et al., 2002; Rudman & Goodwin, 2004). This is attributable to social roles including nurturing roles that contribute to pro-female evaluations and automatic association of males with aggressive tendencies. Explicit measures do not show the same sensitivity (Rudman and Goodwin, 2004).

Bias based on group membership is fast and frugal. Person perception research has shown that social cognition occurs in the right lateral frontal cortex based on stereotypes. Applying individual information to understand others is thought to rely on the medial prefrontal cortex (Mitchell et al., 2008). Furthermore, there are conflicting opinions on the extent to which implicit and explicit bias processing are completely independent of each other (Hofmann, Gawronski, Gschwendner, Le & Schmitt, 2005), or functionally and neurologically dissociable but not completely independent (Ochsner & Lieberman, 2001). This idea of different brain regions being involved in automatic and conscious social cognition is consistent with the dual process models (Lieberman, 2007). It appears likely that different brain regions are involved in the processes of categorisation of people (Mitchell et al., 2008).

The speed at which categorisation happens, group membership, the availability of cognitive resources in the moment and motivation may be factors that determine the bias that emerges when individuals or groups encounter each other (Lieberman, 2007). Inhibition of bias is possible by conscious thought but direct suppression may lead to a rebound effect (Lieberman, 2005). Fiske (2002) suggests,

bias is more automatic than people think but less automatic than psychologists thought, and an enduring phenomenon.

Another neural concept identified in the literature as contributing to the formation of perceptions, connection within groups, self-concept, and the emergence of bias is mirror neurons. di Pellergrino and colleagues first discovered mirror neurons as a class of neurons in primates in 1992 (Cook, Bird, Catmur, Press, & Heyes, 2014). Mirror neurons may manifest in humans such that one will take on some of the characteristics of those around them, particularly those within the circles or groups with which the individual is closely associated. This can take the form of adopting others postures, intonations, facial expressions as well as motivational states and emotions (Decety & Jackson, 2004). This goes as far as synchronising the inner states of individuals through brain mechanisms that mirror the experience of others (Gutsell & Inzlicht, 2010). This may contribute to making it difficult to respond in an equally sensitive way to out-group members.

The higher level of sensitivity towards in-group may be derived from shared neural networks, including the mirror neuron system. Gutsell & Inzlicht (2010) highlight the role of perception-action-coupling in interpersonal relationships as being: “essential for a number of forms of interpersonal sensitivity, including emotional contagion, empathy, theory of mind and action and intention understanding” (Gutsell & Inzlicht, 2010, p. 842). Mirror neurons are involved in both action recognition and the coding of intentions (Iacoboni, 2005). Therefore, mirror neurons contribute to implicit bias, particularly in the context of in-group/out-group dynamics.

In summary, psychological evidence from neuroscience suggests that humans think differently about people in their in-group versus those in their out-group. Fast and frugal categorisation supported the evolution of humans when physical survival was an imperative in a context of constant physical threat. Gender is one of the enduring cues that leads to automatic group categorisation and contributes to implicit biases. Automatic categorisation can be mitigated when individuating information is processed, however, in a busy world, one may not always have the cognitive resources available to notice or moderate implicit biases. Implicit bias is compounded by the unconscious connections one makes with their in-group members that mirror thought, feelings, and actions. The fast-evolving field of social cognitive neuroscience provides the opportunity to better understand the roles different brain regions play in

conscious and unconscious thought. In turn, this is leading to insights into ways of addressing biases within the complexity of the modern workplace.

### 2.3 Complex adaptive systems

The persistence of gender bias in the modern workplace may be a function of inherent complexity (Ridgeway & Correll, 2004; Simpkins, 2014). In this regard, complexity requires an approach beyond that used for traditional problems. In complexity, there is a need to understand the dynamics of the issue and explore ways to make progress (Snowden & Boone, 2007), rather than to come up with one solution or process. Complex adaptive systems (CAS) theory provides a theoretical foundation with the potential to provide insights to the issue of gender bias, and ways to understand the gender system.

CAS grew out of the field of organisational science going back to the 1960s when the open systems view of organisation developed (Anderson, 1999). Its development reflects the emergence of SCN in that it is an interdisciplinary field with application across diverse areas including: behavioural and social sciences (Eidelson, 1997), economics (Beinhocker, 2006), anthropology (Lansing, 2003), efficiency and innovation (Tilebein, 2006), organisational behaviour and leadership (Boal & Schultz; 2007; McDaniel, 2007; Wheatley, 2006) and, more specifically, gender bias (Hogue & Lord, 2007; Ridgeway & Correll, 2004).

There is no one clear definition of complexity or of CAS (Holland, 2006); however, there is broad agreement in the literature that complexity and CAS have certain characteristics. McDaniel has distilled the literature down to five characteristics: “CAS are characterised by: diverse agents that learn, that interact with each other in non-linear ways, and therefore, self-organise, have emergent properties, and co-evolve” (McDaniel, 2007, p. 22).

One of the hallmarks of CAS is “the notion that at any level of analysis, order is an emergent property of individual interactions at a lower level of aggregation” (Anderson, 1999, p. 219). These characteristics and the notion of nested, interconnected networks may provide insight to the complexity of gender bias. A CAS lens can be used to consider the emergent properties of in-group/out-group dynamics and understand the role played by neural networks and mirror neurons (Hogue & Lord, 2007) in interconnected networks at recurring levels.

Bias is a subset of perception (Freeman & Ambady, 2011) and insights can be drawn from CAS (Hogue & Lord, 2007) to understand the dynamics of bias. These insights are derived from: connectionist theory; systems properties such as adaption, patterns, unpredictability, recurring interconnected levels, attractors and multiple states, and the way a system adapts to cues and probes.

In a complex adaptive system, interdependent linkages among agents are described as couplings (Hogue & Lord, 2007). These couplings are characterised by their strength and direction. In a connectionist network, the agents are neuron-like processing units recurring at different levels. These units receive and pass on behaviour through couplings to one another influenced by the strength between units and aggregates, and the weights between units and aggregates (weight is weighting given to information). These ideas correspond to the description Gutsell and Inzlicht (2010) provide of perception-action-coupling and the mirror neuron system. Bringing ideas from CAS and SCN together suggests that the mirror neuron system occurs at the lowest level of recurrence in a connectionist network. Its attributes are reflected in the layers from intrapersonal to group to organisation. Insights into the biases operating within these systems (strength, weighting, and direction of connections) is therefore useful when trying to understand and intervene in the propensity for bias at different levels.

In summary, recognising the multi-layered, interconnected, and complex dynamical nature of gender bias in organisations suggests that the issue can be addressed by applying CAS approaches. This is supported by Hogue and Lord's (2007) observation that: "The critical point for understanding gender bias...is that both...perceptions and gender stereotypes reflect dynamic constructions that occur through the interactions of units in a recurrent layer of connectionist networks" (Hogue & Lord, 2007, p. 377). This implies that at the individual level the gender bias that holds people, and that people hold, can be changed over time to have an enduring effect throughout an organisation.

## 2.4 Literature review summary

In summary, the literature provides evidence that gender bias persists in organisations despite decades of efforts to address the problem. The persistence and pervasiveness of the issue suggests that something is operating beyond the consciousness of both those who are participating in the workforce and those attempting to solve the problem. It is a complex issue requiring interventions to build understanding of the problem rather than solutions that address it head on (Snowden & Boone, 2007). Understanding the nature of bias (explicit and implicit) as well as appropriate theories (neuroscience and complex adaptive systems) to delve deeper into the dynamics at play may provide clues to making sustainable progress.

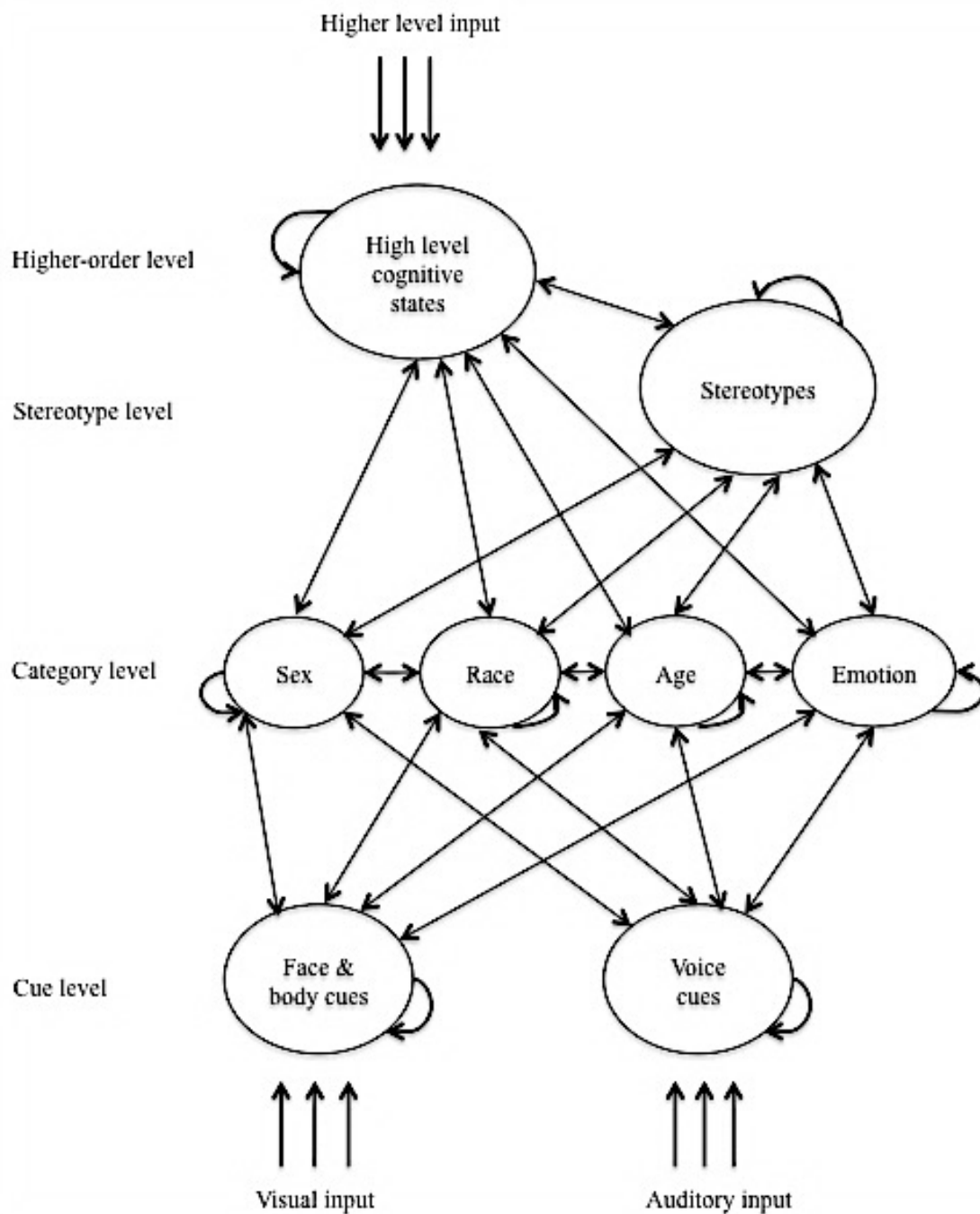
### 3 Theoretical foundations

The theoretical framework for this study is based on the dynamic interactive theory of person construal (Freeman & Ambady, 2011; Freeman, Schiller, Rule, & Ambady, 2010). This theory builds on the notion of categorisation, discussed earlier, as well as dual process models of cognition (Satpute & Lieberman, 2006). The literature reviewed generally focusses on categorisation and the impacts of categorisation with a general assumption that a stable category is quickly arrived at either via automatic processing or conscious thought. It is only recently that the neural origins of categorisation have been explored as a dynamic interactive process. The theoretical model of person construal has been developed from studies that endeavour to understand the perceptions formed when a person sees another's face (Bodenhausen & Macrae, 2006; Zebrowitz, 2006).

The model assumes that person construal is an on-going dynamic process involving processing at four levels. The role of top down and bottom up stimuli is modelled to better understand and illustrate the interrelationships between information at the four levels of neural processing incorporated in the model (Figure 3). The bottom up and top down inputs into the model generate activity in nodes and, because everything is interconnected, there may be conflicting activation that may excite or dampen activity in other nodes. For example, if a woman is introduced as a manager in an occupation that is stereotypically male, the sex category node would be activated and then this would generate activity in the stereotype node. This would mean reconciling stereotypes held about women with stereotypes held about the typical manager. This may then call on, and be informed by, higher level input and processing, such as the organisations diversity programme and in-group expectations. This is connectionist theory in action – the system will eventually settle on a category, adopt stereotypes and process higher level information that combine to manifest in behaviour. This settled state is referred to in systems language as attractor state (the tendencies of a system as time passes).

The model provides an opportunity to gain insight to the dynamics of the gender system. Insight can then lead to research that probes the system to better understand the dynamics at play, including bringing the current attractor state into focus. This nuanced view of the gender system better informs the types of

interventions an organisation could introduce to nudge the system in the desired direction or maintain the current attractor state. The methods used in this study are directed towards providing insight into these system dynamics by focusing on the category level of the model while making observations about the possible bottom up and top down influencers in play within the systemic context of an organisation.



*Figure 3.* Diagram of the dynamic interactive model of person construal, (Freeman & Ambady, 2011, p. 6).

The dynamic interactive theory of person construal (Freeman & Ambady, 2011) builds on CAS concepts and provides a theoretical rationale for exploring the relationship between in-group composition and gender bias through a CAS lens. The dynamic interactive model of person construal integrates ideas such as top-down and bottom-up interactivity and connectivity, continuous dynamics, complexity, recurrent connectionist networks, attractor dynamics, and constraints.

### 3.1 Research model

The model (Figure 4) developed for this research includes three major constructs: implicit gender bias, explicit gender bias and in-group composition. Explicit bias includes aspects of both old fashioned and modern sexism. Participants demographic details form a fourth construct to support analysis.

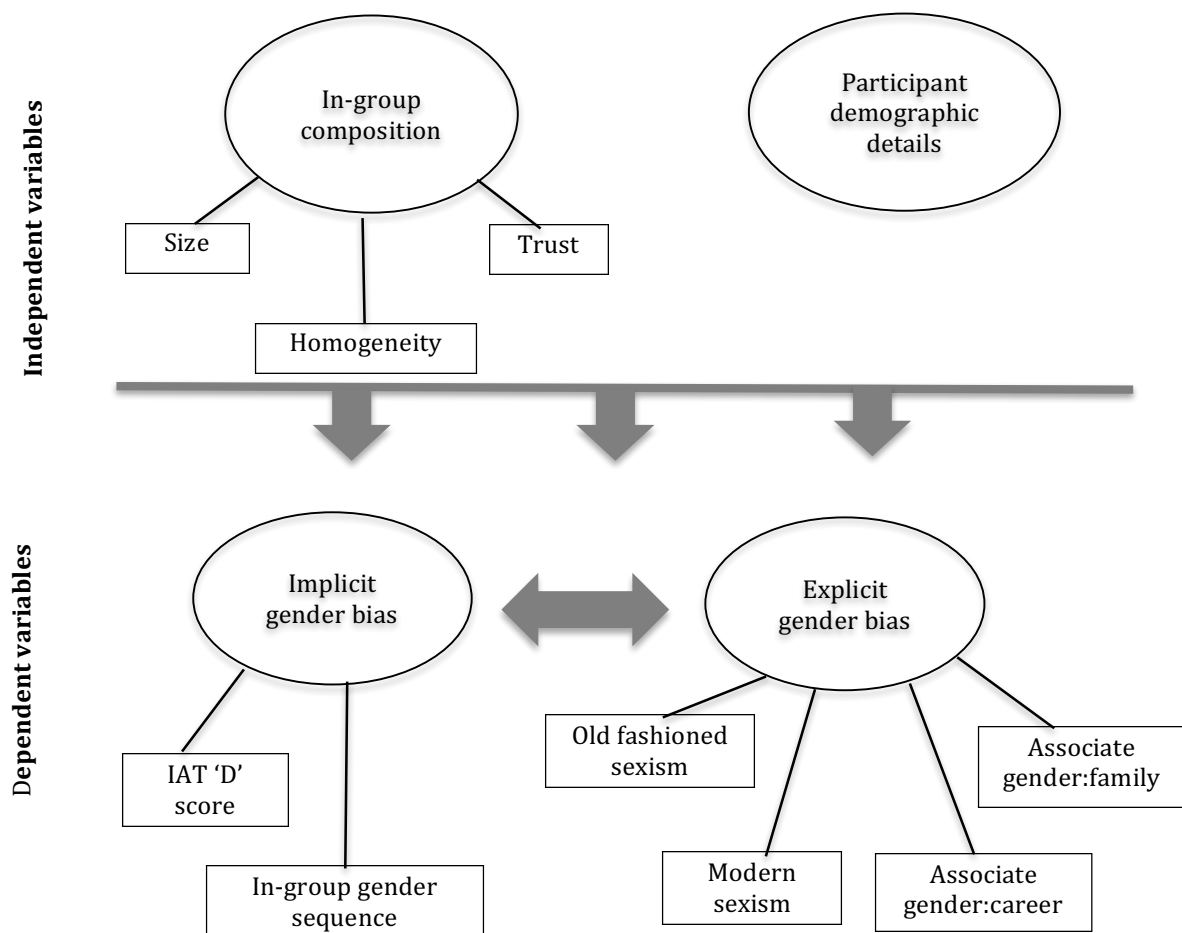


Figure 4. Research model



### 3.1.1 Defining the constructs in the research model

This section defines each of the three constructs along with the variables used to operationalise the research and supporting demographic variables relevant to this research. The central constructs of in-group, implicit bias, explicit bias, and gender bias have been defined in detail in Chapter Two. The definitions presented here flow from the Chapter Two discussion and introduce the variables.

**In-group composition** – In-group<sup>4</sup> is described to participants in this research as: “In-group” comprises those people who you intuitively trust. For example, often in professional life we come across challenges that stymie us. In these situations we seek the insights and opinions of others. The people we turn to in these situations are members of your in-group for the purposes of this study.

Three variables are used to provide insight into in-group: size, homogeneity, and trust.

*Size* is the numerical count of the total number of people listed in one’s in-group.

*Homogeneity* is a measure of the extent to which the make up of one’s in-group is consistent with one’s gender. For example, a female who reports 5 females and 7 males in their in-group will have a homogeneity score of 41.67. This is calculated as  $5/(5+7) \times 100 = 41.67$ . A male with same mix of gender (7 males, 5 females) for their in-group will have a homogeneity score of  $7/(5+7) \times 100 = 58.33$ . A male with an in-group comprising only males or a female with an in-group comprising all females will have a homogeneity score of 100.

*Trust* is the extent to which one trusts members of their in-group. A trust level is assigned for each in-group member listed in the survey response. The trust scale ranges from 1 to 10 where 1 = somewhat trusted and 10 = absolute trust. In-group trust is measured by calculating the average trust score. For example, an in-group with 5 members with trust scores of 10, 6, 7, 6 and 4 will have a trust score of 6.6 calculated as:  $(10+6+7+6+4)/5 = 6.6$ .

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<sup>4</sup> In-group composition, for the purposes of this study, is based on a professional context, not a social context.

**Implicit gender bias** – The definition of gender bias used in this study is derived from Fiske’s (1998) definition of bias. Gender bias has been defined in Chapter Two as: *gender bias occurs when a person makes sense of another person or group in a gender stereotypical way leading to categorisation, decisions, and behaviour based on the target’s gender*. The definition of implicit bias comes from Project Implicit<sup>5</sup>: “positive and negative evaluations that occur outside of our conscious awareness and control”. Implicit gender biases are the unconscious aspects of gender bias. In this study two variables indicate the extent of implicit gender bias: implicit association test D score, and in-group gender sequence.

*Implicit association test D score* is the measure of implicit gender bias derived from the career / family implicit association test (IAT). A full description of the IAT is provided under methodology in Chapter Four.

*In-group gender sequence* refers to the order in which participants in the survey list members of their in-group with respect to gender. For example, does a female participant list a female as the first person in the sequence of their in-group membership?

**Explicit gender bias** – Explicit gender bias refers to the attitudes and beliefs that we have about a person or group on a conscious level based on their gender. Four sub-variables have been used to explore explicit gender bias: old-fashioned sexism, modern sexism, association of gender with career, association of gender with family.

*Old fashioned and modern sexism* are terms used to describe explicit forms of gender bias (Swim et al., 1995). The old fashioned (OFSS) and modern sexism scales (MSS) are measures of explicit gender bias used in this study. A full description of these scales is provided under methodology in Chapter Four.

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<sup>5</sup> Project Implicit is a consortium comprising Harvard University, the University of Virginia and the University of Washington. The consortium provides research support and carries out social cognitive neuroscience research including developing measures of implicit bias.

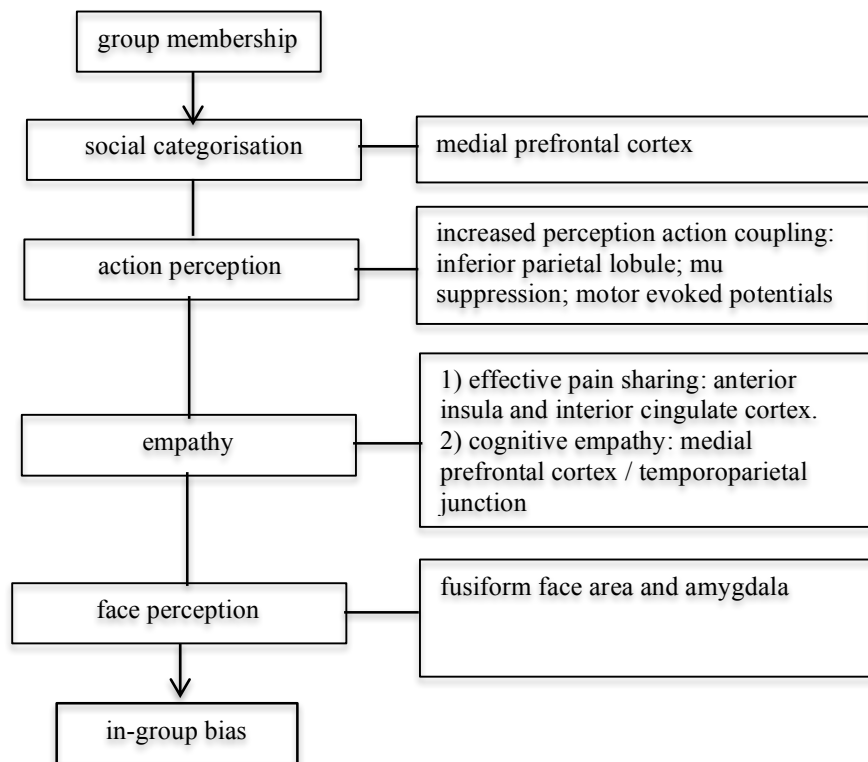
*Association of gender with career and association of gender with family* are variables based on the career:family IAT. Including these variables provides a comparison between the IAT implicit score and the extent to which respondents explicitly claim to associate gender with family and gender with career (Nosek et al., 2007).

**Participant demographic details** – Demographic details collected are to enable categorisation of valid responses into sub-groups. The demographic details collected are listed in Appendix 1.

### 3.2 Research hypotheses

Four research questions have been identified in the opening chapter, including the key question: *To what extent does the composition of in-group associate with gender bias?* This section expands on the research questions through hypothetical relationships that will be empirically tested using the methodology described in Chapter Four. The research model (Figure 5) shows in-group composition as an independent variable with a relationship with each of the dependent variables of implicit gender bias and explicit gender bias. Therefore, the composition of an individual's in-group may have an association with that individual's degree of gender bias, both at a conscious level (explicit bias) and a subconscious level (implicit bias).

Identity with in-group is described in the literature as being one of the core drivers of bias (Brewer, 1999; Cunningham & Zelazo, 2007; Molenberghs, 2013; Van Bavel et al., 2008). Gender is one of the obvious categories that humans notice when determining their group membership, relationships, and responses, but evidence is growing that individuating information and greater awareness may mitigate the automatic aspects of biases (Fiske, 2002; Mitchell et al., 2008). This supports the notion that humans can teach themselves to recognise and control biases through cognitive executive functions (Molenberghs, 2013). The ability to control automatic bias relies on both the will to do so and the cognitive resources being available. Similarly, for explicit bias, norms, expectations, the basic human needs for approval and acceptance contribute to explicit bias along with the notion that humans think in greater depth about in-group members than out-group members (Van Bavel et al., 2008; Molenberghs, 2013). Molenberghs (2013) provides a schematic overview of the interplay between group membership and in-group bias showing the brain areas involved (Figure 5).



*Figure 5.* How group membership can modulate the neural correlates in social categorisation, action perception, empathy, and face perception, and how this can lead to in-group bias. Adapted from Molenberghs (2013, p. 1513)

This research focuses on group membership based on gender with expected statistical associations between in-group composition (size, homogeneity, and trust) and measures of implicit and explicit bias. The following hypotheses propose relationships between in-group composition and associated biases.

### 3.2.1 H1. In-group composition in relation to the IAT D score

**Hypothesis 1.** In-group composition will be associated with implicit gender bias, as delineated below in the sub-group hypotheses.

**Hypothesis 1a.** In-group composition, as measured by the homogeneity score, will be negatively associated with implicit bias, as measured by the IAT D score. For example, a male with a low male composition in-group, will score higher with respect to implicit (unconscious) bias, than a male with a high male composition in-group. This hypothesis is based on the counter intuitive assumption that applies when gender is a bias category; that is, a dominant in-

group will tend to exhibit lower levels of implicit bias (Rudman & Goodwin, 2004).

**Hypothesis 1b.** In-group composition, as measured by trust, will have a positive association with implicit bias as measured by the IAT D score. This means that a participant with an in-group with higher levels of trust will score higher with respect to implicit (unconscious) bias. The assumption underlying this hypothesis is that, all other things being equal, there will be stronger in-group influences at an unconscious level when trust levels are high.

**Hypothesis 1c.** In-group composition, as measured by size, will have a negative association with implicit bias as measured by the IAT D score. This means that a participant with a smaller in-group will score higher with respect to implicit (unconscious) bias. This is based on the notion in the literature (Brewer 1999) that larger groups may demonstrate ambivalence whereas smaller groups are more likely to have stronger bias.

**Hypothesis 1d.** Implicit (unconscious) bias as measured by the IAT D score will be stronger when the first member of an in-group is male. The order in which a participant lists their in-group is suggested as an indicator of implicit bias; therefore, when a male is listed first it may suggest a stronger bias towards males and work.

### 3.2.2 H2. In-group composition in relation to explicit bias

**Hypothesis 2.** In-group composition will be associated with explicit bias, as delineated below in the sub-group hypotheses.

**Hypothesis 2a:** In-group composition, as measured by the homogeneity score, will be negatively associated with explicit bias. For example, a male with a low male composition in-group, will score higher with respect to explicit (conscious) bias, than a male with a mixed composition in-group.

**Hypothesis 2b:** In-group composition as measured by trust, will have a positive association with the explicit bias scales. This means that a participant with an in-group with higher levels of trust will score higher with respect to explicit (conscious) bias. The assumption underlying this hypothesis is that, all other things being equal, there may be a tendency to consciously fulfil group expectations when trust levels are high.

**Hypothesis 2c:** In-group composition as measured by size, will have a negative association with explicit (conscious) bias as measured by the explicit bias scales. This means that a participant with a smaller in-group will score higher with respect to explicit bias. This is based on the notion in the literature that larger groups may demonstrate ambivalence whereas smaller groups are more likely to have stronger bias (Brewer, 1999).

### 3.2.3 H3. Implicit bias measure (IAT D score) in relation to explicit bias measures.

Debate in the literature is ongoing about the extent to which implicit and explicit biases are completely independent of each other or functionally and neurologically disassociated but not completely independent (Hofmann et al., 2005; Lieberman, 2007; Ochsner & Lieberman, 2001). This debate is reflected in the results from studies that have applied measures of implicit and explicit bias. The following hypothesis tentatively proposes a relationship between implicit and explicit bias.

**Hypothesis 3.** Implicit bias, as measured by the IAT D score, will have a positive association with explicit bias as measured by the explicit bias scales used in this study.

The hypotheses outlined are designed to examine the relationships between in-group composition and implicit (unconscious) and explicit (conscious) bias. In addition, the relationship between the implicit measure of gender bias used (IAT D score) and the explicit measures of gender bias is also examined. By combining in-group composition with the implicit and explicit measures an opportunity is provided to test how the make-up of in-group across a number of dimensions (size, trust, homogeneity) may lead to gender bias manifesting in different ways.

This chapter has outlined the theoretical model for the research including constructs and variables used to operationalise the constructs. It is a model that recognises both systemic and cognitive elements underlying the formation of gender bias within the human mind. Against the backdrop of the theoretical model a series of hypotheses have been proposed which link in-group composition to gender bias. Chapter Four will explain the methodology applied to test the hypotheses.

## **4 Research methodology**

This chapter describes the methodology used for the study starting with the rationale for the research design. It includes discussion as to the selection of the research site, the sampling plan, data collection procedures, and respondent demographics. Instrumentation used in this study is described in detail, including operational measures used for each construct. Data accuracy and screening are addressed. The chapter closes with a description of the data analysis plan.

### **4.1 Research design**

This first section outlines the rationale for the research approach and describes the research design. The criteria for selection of the research site are discussed, the sampling plan is presented, the testing of aspects of the research design is outlined, and data collection procedures are described.

#### **4.1.1 Research approach**

For this study, a quantitative survey approach has been taken to test the association between the variables of in-group composition and biases (implicit and explicit bias). This approach has been taken recognising that the research constructs of in-group composition and gender bias are well established in the literature. The burgeoning field of neuroscience research and application of complexity ideas referred to in the literature review for this study (Chapter Two) also support the quantitative approach taken. The range of established measures that operationalise the constructs in this research context enable a valid and reliable quantitative approach to be taken. The research design incorporates several proven survey instruments.

The purpose of the design is to enable measurement of the relationships between in-group composition and the manifestation of implicit and explicit bias. An integrated online tool has been designed and developed as part of this study. The tool captures in-group composition and uses established measures of implicit and explicit bias to operationalise the research constructs.

#### **4.1.2 The research site**

A single large Australian professional services firm was selected as the research site. The rationale for the single site selection was: testing the relationship between in-group composition and the manifestation of bias does not require multiple sites; professional services firms are highly aware of gender bias; the messaging and

approach to participants could be consistent; and the logistical issues were minimised. Focusing on a single site removed the effect of potential variation caused by differing organisational or industry perspectives on gender bias. The effects of internal cultural variation within the site selected is minimised due to the organisation having a strong homogenous culture and national gender strategies.

The criteria for site selection were as follows: 1) an organisation that is representative of mainstream professional services firms, 2) an awareness of gender issues and a gender diverse workforce, 3) the organisation is supportive of the study, and 4) the organisation is large enough to enable random sampling across its divisions, functions, and hierarchical levels.

The organisation participating in this study meets these criteria. It is one of the “big four” professional services firms in Australia with over 4,000 partners and employees. It has a gender diverse workforce and persistent indicators of potential on-going bias despite equally persistent initiatives to address the issue. The firm is known to take an active approach to gender bias and this is evidenced by attainment of Gold Tier Employer status in the Australian Workplace Equality Index and being awarded Employer for Choice for Gender Equality by the Workplace Gender Equality Agency.

#### **4.1.3 Sampling plan**

A plan was developed to ensure adequate representation across horizontal (position) and vertical (function / location) strata in the organisation. Areas in the organisation were selected that were able to be supported in the process by internal People, Performance and Culture consultants and that were not swamped by other initiatives or surveys running in the organisation. The People, Performance and Culture division in the firm identified the participants using their institutional knowledge to create a mixed sample (Table 1). The mixed sample comprising a combination of broad position categories, functional groups and locations provided the opportunity to test for variation within the organisation.



Table 1

*Survey Distribution*

<b>Division</b>	<b>Business Unit</b>	<b>State</b>	<b>Number</b>
Audit	CFO Advisory	Vic\NSW	84
Shared Services	People, Performance & Culture	mixed (mainly NSW)	117
Private Equity	Brisbane Private Enterprise	QLD	80
Shared Services	Risk Management	mixed	59
Shared Services	Markets & Growth	mixed	24
Tax	Mixed	SA	39
			403

**4.1.4 Data collection**

Each of the four hundred and three selected participants were emailed a link to an online survey tool. The link was imbedded in an email encouraging participation sent to participants by the General Manager, People, Performance and Culture. The firms internal email system was used to avoid rejection by firewall security. Endorsement by the General Manager was to assist response rates and contextualise the survey (Appendix 2). The organisation was provided a research information sheet approved by Victoria University's ethics committee (Appendix 2). The email also contained the researcher's contact information and an option to receive a summary of the results.

The context and starting instructions contained in the email were followed by additional instructions contained in the survey tool (Appendix 1). Each section of the survey tool provided additional instructions. The instructions and sequencing of the instruments within the tool are designed to minimise the effects of cueing and socially desirable responses. For example, the initial explanation refers to group dynamics rather than gender or bias. The IAT was sequenced first as implicit measures operate in a way that is difficult to cognitively recognise and is therefore less likely to influence the answering of subsequent questions. This was followed by in-group composition before moving into the self-report questions that operationalise the explicit bias variables. The final questions captured social demographic data.

The data collection went well, with the response count able to be viewed online to monitor progress. A 2-week window was provided to complete the survey with reminders at 5 days and another reminder at 10 days with a 5-day extension provided.

#### 4.1.5 Response rates and respondent demographics

The response rate was pleasing despite initial reservation about the length of the instrumentation and the number of sections. Each section measured distinct variables and there was potential to overload participants with instructions or take up too much time. After the survey closed, Project Implicit provided an extract of data containing one hundred and forty responses, a response rate of 35%. After cleaning the data this was reduced to one hundred and fourteen valid responses (Table 2).

Table 2

*Valid Survey Responses*

Division	Business Unit	Male	Female	Number
Audit	CFO Advisory	6	9	15
Shared Services	People, Performance & Culture	8	46	54
Private Equity	Brisbane Private Enterprise	5	9	14
Shared Services	Risk Management	5	10	15
Shared Services	Markets & Growth	2	5	7
Tax	mixed	3	6	9
		29	85	114

## 4.2 Instrumentation

This section provides a detailed discussion on the operationalisation of each construct in the research model. The approach combining in-group composition with implicit and explicit bias is novel. This has required creating measures to operationalise in-group composition. Implicit and explicit bias rely on prominent scales found in the literature.

### 4.2.1 Operationalising in-group composition

The operationalisation of in-group is a novel aspect of this study. The literature highlights that gender dominates race, age, and occupation as a bias and describes gender as a primary frame when humans are shaping their social relations

(Barberá, 2003; Fiske, 1998; Ridgeway, 2009). People will also tend to trust in-group members more than others and the larger one's in-group the more likely it is that the in-group norms will be dominant (Brewer, 1999). The variables that have been selected to measure in-group in this study are based on these notions.

The construct of in-group composition comprises three variables: homogeneity, size, and trust. Homogeneity is a measure of the extent to which one's in-group reflects their own gender, for example, a female with an in-group of 10 comprising four males and six females will have a homogeneity score of 60. The count of the number of people in one's in-group is the measure of the size. Trust is derived from the extent to which each individual member of one's in-group is trusted. The trust measure for one's in-group is the average of the individual trust scores. The three variables of homogeneity, size, and trust operationalise in-group composition and enable different characteristics of in-group to be used to understand the impact on the dependent variables.

#### **4.2.2 Operationalising explicit bias**

The literature highlights that different constructs of gender bias and various psychological attributes create a challenging conceptual landscape for researchers and for the development of reliable and consistent measures. Since Constantinople's (1973) seminal review of gender measures, studies of gender bias have used a variety of approaches, often combining tools that endeavour to elicit both explicit and implicit bias.

Explicit measures of gender bias have followed the same course as measures of racial bias, although lagging about 20 years behind (Masser & Abrams, 1999). As social attitudes have changed, a shift has been observed from overt racism to more subtle forms of racism and measures have been adapted. Early racism measures assessed prejudice in a straightforward and transparent way and included: "Bogard's (1925) Social Distance Scale, Thurston's Equal Interval scale (1927), Guttman's scalogram (1950), and Osgood, Suci and Tannebaum's (1957) semantic differential" (Brauer, Wasel & Niedenthal, 2000, p. 79). These measures reported a decline in prejudice attitudes aligned with changing of attitudes towards overt expressions of prejudice. New measures were developed to assess levels of 'subtle' bias, although still explicit and self-reported. This subtle bias originates from the tension between biases and ideals, both with origins in culture, and is then fuelled by contemporary

social images and information via media (Fiske, 2002). In the gender literature this subtle bias is also referred to as contemporary sexism.

Three measures were developed under the general heading of contemporary sexism, as follows: the Ambivalent Sexism Inventory (ASI) (Glick & Fiske, 2001), the Neosexism Scale (Tougas, Brown, Beaton, & Joly, 1995), and the Modern Sexism Scale (Swim et al., 1995). Subtle forms of bias include 'sexist benevolence' which may enable men to maintain a positive self-image as provider and protector that perpetuates inequality. This view may even encourage cross gender helping relations while perpetuating traditional gender roles (Shnabel, Bar-Anan, Kende, Bareket & Lazar, 2016). The role of provider and protector is reinforced in prejudice by the extent to which women see acts of discrimination as less serious when the perpetrators express a protective justification. This is a key finding of Glick and Fiske's (2001) review of 15,000 responses across 19 nations with the observation that: "Women who endorse benevolent sexism are more likely to tolerate, rather than challenge, sexist behaviour when the sexist's motivation can be interpreted as being protective" (Glick & Fiske, 2001, p. 111). Highlighting ambivalence and the interpersonal relationships between men and women are distinguishing features of the ASI. Ambivalence in this context is generated by the opposing evaluative implications of hostile (overt) and benevolent sexism leading to ambivalence (Masser & Abrams, 1999).

Tougas and colleagues (1995) have adapted the modern racism model proposed by McConachay as the basis of the Neosexism Scale and define neosexism as "a manifestation of a conflict between egalitarian values and residual negative feelings toward women" (Tougas et al., 1995 p. 843). The Neosexism Scale focuses mainly on attitudes towards public policies designed to enhance the status of women while recognising that negative beliefs about women tend to be couched in the language of equality rather than inferiority (Campbell, Schellenberg & Senn, 1997). Subsequent research has extended the Neosexism Scale to include research linking with women's and men's collective attitudes toward upward mobility of women in the workplace (Tougas, Brown, Beaton, & St-Pierre, 1999).

The third operationalisation of gender bias, the old fashioned and modern sexism scale, has also been derived from experiences measuring racism. The modern sexism scale categorises the questions to measure three summary factors of subtle sexism. The 'subtleness' is based on the assumption that the language used in the

statements is not sexist. The summary factors are: the denial of continuing sexism, antagonism toward women's demands, and resentment about special favours for women (Swim et al., 1995). A differentiating feature of this scale is its separation of sexism into two distinct components. These components are summarised as 'old fashioned sexism' and 'modern sexism'. Old fashioned sexism focuses on traditional roles, unequal treatment of women and questioning women's intelligence, whereas modern sexism focuses on less sympathetic attitudes towards women's issues and strategies to deal with women's issues (Swim et al., 1995). This two-factor structure is supported by a confirmatory factor analysis; however, the modern sexism component has also been assessed as a valid standalone measure (Campbell et al., 1997).

In summary, the literature discusses the development of explicit measures of bias towards women, following the same trends as research into racism. As social attitudes have changed and bias has become more subtle, measures have had to be adapted. This has resulted in a second generation of measures focusing on respondents' denial of continuing gender bias. Although providing insights into the nature of gender bias, this second generation of explicit bias measures has shown the same vulnerability to participants being cued, subject to situational pressures or answering in a social desirable way, that plagued early measures of overt bias (Brauer et al., 2000). To overcome these vulnerabilities an alternative or complementary approach is to measure unconscious bias, also referred to in this study as implicit or automatic bias.

For this study four variables operationalise explicit bias. The variables are: the old fashioned sexism scale, the modern sexism scale, a question asking the degree to which participants associate female with family, and a question asking the degree to which participants associated male with career. The old fashioned and modern sexism scale was selected because of the multiple break-down it provides for overt and subtle sexism. The latter two questions are adapted from a meta study comparing implicit and explicit measures (Nosek et al., 2007). They were added to enable comparison between the results from the IAT and what participants claimed their attitudes were towards female and family, and male and career.

### 4.2.3 Operationalising implicit bias

In the last 30 years there has been a rapidly growing interest in automatic cognitive processes (Brauer et al., 2000; Lieberman, 2012) and the development of measures to identify implicit biases that are not influenced by social desirability or self-presentation bias. Taking a lead from De Houwer and colleagues (2009), the term implicit is used interchangeably with the term automatic in this study “implicit can best be understood as synonymous with the term automatic” (De Houwer, Teige-Mocigemba, Spruyt & Moors, 2009, p. 350). An implicit measure can be defined as: “A measurement outcome that is causally produced by the to-be-measured attribute in the absence of certain goals, awareness, substantial cognitive resources, or substantial time” (De Houwer et al., 2009, p. 350). Implicit measures are outcomes from a test, rather than the test itself, and emerge quickly with little thought or awareness, for example, comparing descriptors such as descriptors of career with descriptors of family. Computer-based techniques and tests have proven popular in the field of social cognitive research and been developed to measure implicit mental processes (Carney, Banaji & Krieger, 2010; De Houwer et al., 2009; Greenwald, Poehlman, Uhlmann & Banaji, 2009).

Many methods are used in social cognition research. However, two methods accounted for over 60% of the 20 most cited procedures used in research in 2010 (Nosek et al., 2011). The two most popular implicit measures are the implicit association tests (IAT) designed by Greenwald and colleagues (Greenwald, McGhee & Schwartz, 1998) at 49%, and affective priming tasks developed by Fazio & colleagues (Fazio, Jackson, Dunton & Williams, 1995) at over 11% (Nosek et al., 2011). Effective priming generally involves participants categorising target stimuli as being negative or positive (De Houwer et al. 2009), for example, being shown a picture of a woman and associating a series of words with the picture versus the same words with a picture of a man. The IAT is a computer-based procedure that assesses the relative strength between concepts by recording response latencies. The IAT is maintained and developed by Project Implicit.<sup>6</sup> The IAT measures the strength of associations between concepts or stereotypes, in this case the strength of association

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<sup>6</sup> <https://implicit.harvard.edu/implicit/iatdetails.html>

between gender and career, and gender and family. The test is divided into sections with a series of combinations used to arrive at an overall score. The IAT score (Table 3) is based on how long it takes a person, on average, to sort the words in the third part of the IAT versus the fifth part of the IAT. A full explanation of the IAT is provided in Appendix 3.

Table 3

*IAT Scale*

IAT career:family Scale			
-2 to -1	-1 to 0	0 to +1	+1 to +2
strong bias towards female and family	low to moderate bias towards female and family	low to moderate bias towards male and career	strong bias towards male and career

Many of the implicit bias studies using the IAT have been hypothetical and the ‘stranger to stranger’ element and lack of real-world factors has led to some challenges of the theories and research relating to implicit gender bias in organisations (Copus, 2005; Landy 2008). These challenges have provoked a strong response from researchers defending hypothetical and laboratory style studies as ways of developing hypothesis and theory that produces valid generalisable results (Greenwald, 2008; Heilman & Eagly, 2008; Nadler & Stockdale, 2012). The hypothetical studies are also supported by studies carried out in the workplace showing that implicit bias is a determining factor in the persistence of gender bias (Greenwald, 2008). The career:family IAT has been selected as the implicit measure for this study based on the robust research supporting it, its accessibility, the existence of a gender specific IAT measure, and the support provided by Project Implicit.

#### **4.2.4 Relationship between explicit and implicit measures of bias**

Although there is consensus in the literature that implicit bias is a determining factor in the persistence of bias, there is considerable on-going discussion about the relationship between explicit and implicit measures and the constructs that each may measure (Hofmann et al, 2005). When a measure of social desirability is linked to implicit measures the IAT measure remains relatively unaffected, whereas explicit measures have been shown to be affected by socially desirable responses (Greenwald

et al., 2009). There are also contrasting findings when correlations between implicit and explicit measures are compared. Often the correlations between explicit and implicit measures are both low and sometimes strong; however, implicit measures reliably predict behaviour (Hofmann et al., 2005). In their meta-analysis Hofmann and colleagues (2005) identify five potential explanations for these discrepancies:

1. Drawing on Fazio's MODE model (Fazio & Olson, 2003) explicit and implicit measures may be highly correlated for relatively uncontroversial topics such as consumer preferences, but correlations may be low when the topic is more sensitive, for example, gender bias in the workplace.
2. If an implicit representation "is the introspectively unidentified (or inaccurately identified) trace of past experience" (Greenwald & Banaji, 1995, p. 5) then the differences in correlations could be attributed to either differences in people's awareness of implicit representations or that higher correlations are being caused by spending more time on introspection.
3. The difference between explicit and implicit measures could be because people access independent representations based on cognitive effort. Correlations may be high when people make judgements spontaneously and low when people take time to deliberate.
4. Methodological factors and design, including the perceived relationship between the items in the implicit and explicit measures, may mean that correlations are unlikely.
5. The constructs being assessed may be completely independent. If this were the case correlations may emerge but they would be random across studies.

The meta study focused on trying to identify how introspection, social desirability, and spontaneity impacted correlations between implicit and explicit measures. Spontaneity showed the greatest effect on increasing correlation with little evidence of social desirability or introspection playing a role in influencing correlations. This does not mean these latter factors should be dismissed; individual differences in the motivation to control overt responses, or individual differences in introspection may play out differently for different topics (Hofmann et al., 2005).

The questions raised in the literature relating to implicit and explicit measures have led to this study combining the IAT with the old fashioned (OFSS) and modern sexism (MSS) scales. The OFSS and MSS have been validated by a study carried out



by Swim and colleagues (1995). The study showed adequate internal reliability ( $\alpha = .66$  and  $.84$  respectively) and that the OFSS correlates with the modern sexism scale ( $r = .54$ ) (Swim et al., 1995). The study also showed higher scores for men than women on both scales. Similar studies have confirmed the reliability of MSS and its validity as a measure of subtle sexism (Amy, Hanges, Sipe & Salvaggio, 1999; Campbell et al., 1997). This combination of measures will enable the capturing and comparison of implicit bias with subtle and hostile sexism and add a contribution to understanding the relationships between these measures when applied to gender bias in an organisational context.

The OFSS and MSS together with the IAT provide measures of the dependent variables. Identifying research measures that are reliable is the greatest concern to most researchers (Bryman & Bell, 2011). The measures selected for this research overcome this concern. A description of the measures and the design of the data capture tool is contained in Appendix 1.

#### **4.2.5 Control variables**

Data was collected on a number of control variables. These include organisational demographic factors and personal demographic factors (Appendix 1). These factors provide added flexibility to carry out hierarchical regression on dependent variables and test how demographic factors may affect the relationship between in-group composition and bias.

#### **4.2.6 Operationalising summary**

Combining the IAT, explicit measures, and in-group composition is novel in its approach. It was therefore important to test the relationship between key variables (Bryman & Bell, 2011). Before completing the technical design, the relationship between the IAT and in-group, and the method of gathering in-group data, was tested in a small pilot study. The issues identified in the pilot informed the final design and approach (Appendix 4).

Project Implicit was engaged to provide the technical IT support to integrate the IAT, explicit bias career:family questions, old fashioned sexism scale, modern sexism scale, in-group composition, and demographic data capture into a single web-based tool that research participants responded to in one online session. The development took an iterative approach with final real-world testing before release. The testing checked the logic of the flow, instructions, and time taken to complete the

survey. Time taken varied between approximately 10 and 22 minutes. The URL link was tested with the participating organisation to ensure that the survey tools were compatible with its IT environment and could be accessed, completed and saved without interference from a firewall or rejection for other technical reasons.

This section has described the measures used to operationalise the research model (Figure 4) outlined in Chapter Three, and the integration of those measures into a single online tool. This study has 18 variables, including sub-scales and control variables. Each participant record can have up to 68 items of data that go towards making up the measures of each variable.

### 4.3 Data file accuracy and screening

Before analysing the data, a number of steps were taken to assess the integrity of the file. These included visual and statistical tests. The issues addressed were:

**Accuracy of data input.** The data was captured online, minimising the risk of data input inaccuracies. For the IAT test two validation parameters were generated by the test process. These parameters measured the number of errors and the speed of completion. Records with an error score greater than or equal to 0.3 or a response score (speed) greater than or equal to 0.1 were excluded from the sample. These validation parameters identified records that contained too many errors to be valid or where the slow speed of completion potentially undermined the validity of implicit measurement. The old fashioned and modern sexism scales contained six questions where the scales were inverted. For these six questions the scale was reversed to enable consistency of direction for the scales so in all cases a higher score would indicate stronger bias. For the same reason, the scale for the explicit bias question associating gender with family has been inverted.

**Missing data.** There was an element of missing data although not to an extent as to undermine the study. Eighty percent of participants provided complete data. Records that had no in-group data (six records) were excluded from the sample on the basis that in-group data is fundamental to the independent variables. As a general rule, a within-subject means substitution for missing data was applied for multi-item scales. In the event that a single-item variable was missing, the case was dropped for analysis involving that variable.

**Normality.** Given the sample size  $n = 114$  it was anticipated skewness and kurtosis would not be issues. A visual review of distributions showed a good fit with normal distribution: example graphs follow (Figure 6, homogeneity; Figure 7, IAT D score)

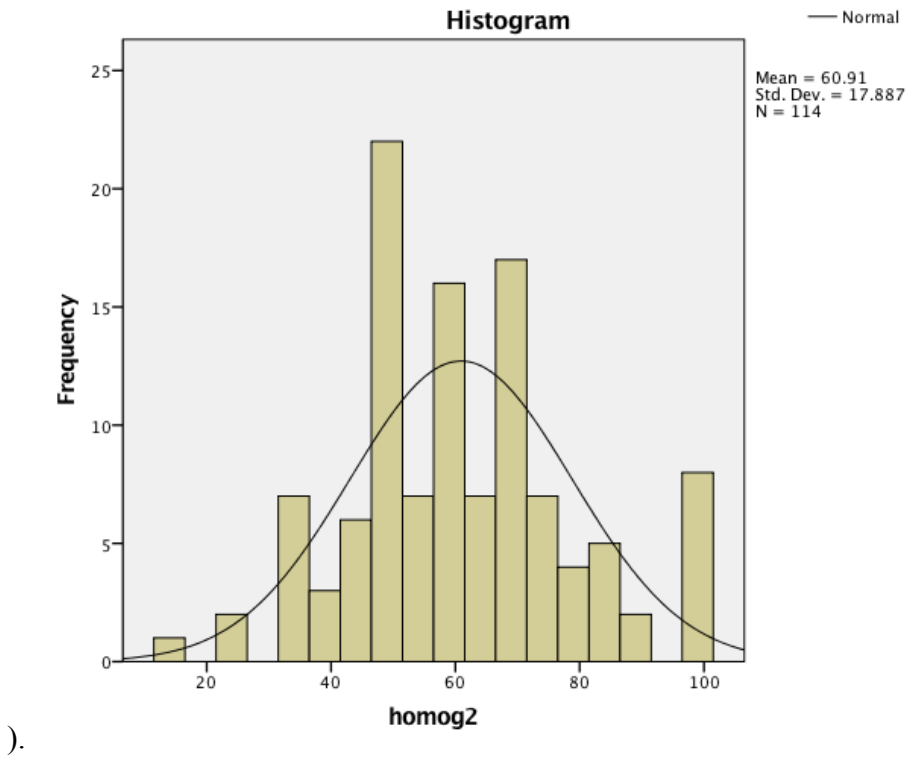


Figure 6. Homogeneity distribution

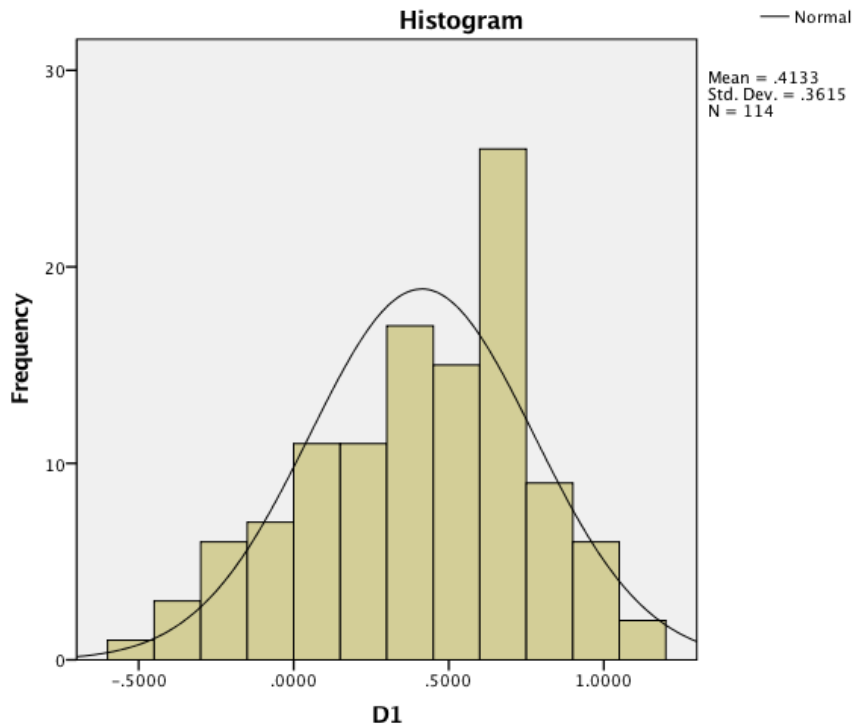


Figure 7. Distribution IAT D score.

In conclusion, the screening procedures confirmed that a data file using a subset of the data was accurate and in a form that enabled further bivariate and multivariate analysis. The next section describes the procedures and statistical tests used to analyse the data.

#### **4.4 Data analysis plan**

The data analysis plan for this research centred around, but was not restricted to, the relationship between the composition of in-group and the manifestation of implicit and explicit bias. The plan included testing the reliability and validity of the measures and the relationship between implicit and explicit measures of bias. The data was planned to be analysed in the following sequence of steps.

Step 1: Discussion of issues of validity and reliability

Step 2: Test for scale reliability

Step 3: Review descriptive statistics

Step 4: Testing for null hypothesis

Step 5: Detailed data analysis and results

## 5 Analyses and results<sup>7</sup>

In this chapter, validity and reliability are discussed first. The analysis then moves to the data collected. The reliability of scales is tested using Cronbach's alpha and descriptive statistics are presented. Hypotheses are tested measuring associations between independent and dependent variables using Pearson's correlation. Relationships are further explored using linear and multiple regression.

### 5.1 Validity and reliability

Validity, in this context, is concerned with the extent to which a measure actually reflects the concept it is supposed to be denoting (Bryman & Bell, 2011). This is referred to as construct validity. The measures of implicit and explicit bias used in this study and the related construct validity have been discussed in Chapter Four. The IAT, MSS, and OFSS have all been subject to extensive scrutiny and research such that they provide a robust measurement framework for the study.

A threat to validity is posed by the potential for participants to answer questions in a socially desirable way. This threat was minimised in the study design by the addition of two explicit measures aligned with the IAT that can be compared with the other explicit scores; and sequencing of the measures within the online tool to minimise the effects of cueing. The order in which people intuitively list their in-group provides an additional indication of implicit bias.

### 5.2 Testing for scale reliability

The old fashioned and modern sexism scales were tested using SPSS for internal consistency. The purpose of this test was to check the extent to which the individual items within the scale are measuring the same thing. The measure used was Cronbach's alpha. A score of 0.7 or higher is recommended for a good level of consistency (De Vellis, 2003; Kline, 2005).

**Old fashioned sexism scale.** The OFSS comprises five questions and uses a five-point Likert scale, where a higher score indicates stronger explicit bias. The Cronbach's alpha score for this sample was 0.521. A score of 0.66 is reported from

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<sup>7</sup> SPSS statistics has been used for all of the statistical tests with guidance from [statistics.laerd.com](http://statistics.laerd.com)

previous studies (Gamst, Liang & Der-Karabetian, 2011). The reliability score does not indicate strong internal consistency. Therefore, given the reliability of this scale, the statistical associations between explicit bias (as measured by the OFSS) and the other variables in the study should be treated with caution. The low reliability score in this study is consistent with the commentary in the literature relating to socially desirable responses affecting the reliability of explicit bias scales (Brauer, et al., 2000; Masser & Abrams, 1999). The scale has been retained in the analysis to provide some indication of movements in the relationship between variables, albeit not a reliable one. The descriptive statistics for OFSS are shown in Table 4.

Table 4

*OFSS descriptive statistics*

<b>Scale item</b>	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
OFS1 capability	114	1	5	1.51	0.87
OFS2 boss	114	1	5	1.68	1.00
OFS3 sport	114	1	4	1.44	0.65
OFS4 logic	114	1	4	1.32	0.60
OFS5 carer	114	1	4	2.19	1.06

**Modern sexism scale.** The MSS differs from the OFSS in that the focus is on more subtle forms of sexism. This scale is expected to be less subject to the effects of socially desirable responses. The MSS comprises eight questions and uses a five-point Likert scale, where a higher score indicates stronger explicit bias. The scores from the eight questions are averaged to create an overall score for modern sexism (Table 5). The Cronbach alpha score for this sample was 0.680 (all questions individually). This indicates a reasonable level of internal consistency in this scale. If the question MS5 is removed (*People treat husbands and wives equally*) then the alpha score increases from 0.680 to 0.859. The scores from this sample are consistent with the 0.84 recorded in previous studies (Gamst et al., 2011). The descriptive statistics for MSS are shown in Table 5.

Table 5

*MSS descriptive statistics*

<b>Scale item</b>	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
MS1 noproblem	114	1	5	1.81	0.79
MS2 anger	114	1	5	2.44	0.91
MS3 discriminate	112	1	5	2.81	0.95
MS4 sexismtv	113	1	5	2.04	0.97
MS5 spouseequal	114	1	5	3.49	1.10
MS6 equalops	113	1	5	2.45	1.07
MS7 concern	114	1	5	2.19	0.93
MS8 govtmedia	114	1	5	2.47	1.01

**5.3 Descriptive statistics**

The descriptive statistics for the independent and dependent variables are provided in Table 6. The demographic data collected was used to identify any significant differences in the statistics across sub-groups. Of interest is the difference between the male and female implicit bias scores (IAT D score). In this sample females showed a higher mean score for implicit bias than males. This is consistent with the Project Implicit public database for 2015 ( $n = 150,277$ ) that has been downloaded for comparison purposes (Table 7).

The literature reviewed investigates this phenomenon within gender groups (Greenwald, et al., 2002; Rudman & Goodwin, 2004). Generally in-group bias will be stronger for the dominant group. Gender groups are the exception. In the case of gender in-group/out-group dynamics males (the dominant group) record lower implicit bias than females.

Of equal interest is that the difference between the male and female implicit bias scores is not reflected in the means of explicit bias measures. In other words, the implicit score for males and females shows a noticeable difference but the explicit scores do not appear materially different for males and females. These findings are consistent with Nosek and colleagues (2007) meta study that compared measures of implicit and explicit bias and will be considered more fully under Hypothesis 3.

Table 6

*Descriptive statistics for variables (whole sample, male and female)*

Variable	All			Male			Female		
	N	Mean	*S.D.	N	Mean	S.D.	N	Mean	*S.D.
Homogeneity	114	60.91	17.88	29	56.10	19.59	85	62.55	17.08
Trust	114	8.16	1.02	29	7.94	1.00	85	8.24	1.02
In-group size	114	9.85	6.85	29	11.66	8.70	85	9.24	6.02
Implicit bias IAT D score	114	0.41	0.36	29	0.28	0.35	85	0.46	0.36
Associate female with career	113	4.64	1.09	29	4.62	0.86	84	4.64	1.17
Associate male with family	111	5.12	1.05	28	4.57	0.79	83	5.30	1.07
Old fashioned sexism scale	114	1.63	0.50	29	1.54	0.43	85	1.66	0.52
**Modern sexism scale	111	2.32	0.70	27	2.69	0.72	84	2.20	0.65

\*S.D. = standard deviation \*\*MS5 removed



Table 7

*Comparison of IAT means. Female and male means from 2015 Project*

<b>IAT</b>	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
PI Females	89,744	-1.78	1.72	0.39	0.37
PI Males	43,839	-1.81	1.87	0.31	0.40
Study Females	85	-0.55	1.11	0.46	0.36
Study Males	29	-0.41	0.83	0.29	0.35

Implicit public dataset (PI)<sup>8</sup> compared with this study (Study).

#### 5.4 Testing for null hypothesis

The primary hypothesis, *in-group composition will be associated with gender bias*, is examined using the Pearson Product Movement Correlation (PPMC) to measure the linear relationship between the continuous scales used in the study. The association of the independent variables (homogeneity, trust, in-group size) is tested against the dependent variables (Table 8).

A review of scatter plots comparing the variables suggests a slight linear relationship between dependent and independent variables. The correlation table (Table 8) produced by SPSS confirms the low strength of relationships, with small correlations reported failing the test of significance. The only exception to the small correlations is the association between size and the explicit question of the extent to which gender is associated with family (ass family). A statistically significant negative correlation,  $-0.18, p = 0.03$ , confirms an association of one aspect of in-group composition with gender bias. However, this is not considered in any way conclusive.

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<sup>8</sup> The IAT public data is hosted by the Open Science Framework <https://osf.io/5ah3t/> on behalf of Project implicit.

Table 8

*Correlations between independent and dependent variables, n = 114*

<b>Variable</b>	<b>IAT D score</b>	<b>OF scale</b>	<b>MS scale</b>	<b>ass career</b>	<b>ass family</b>
Homogeneity	-0.05	-0.15	-0.06	-0.05	0.14
Trust	-0.01	0.10	-0.03	-0.05	0.04
Size	-0.10	-0.10	-0.06	-0.08	-.18*

\*Significant correlation  $p \leq 0.05$  (1-tailed)

The null hypothesis is accepted based on the lack of clear and consistent correlations between the measures of in-group composition and measures of implicit and explicit bias. Therefore, the survey research did not produce statistically significant results as anticipated. It is suggested that this is more than a case of inadequate sample size, given an n of 114. Careful thought was given to what influences and effects may have occurred. Based on these considerations, a rationale was developed and revisions to the data set were made, as discussed below.

This result was unexpected and the generally small correlations led to a review of the data. The data includes the People, Performance, and Culture (PPC) division who account for 47% of the sample. It is likely that this group will have a response bias to the survey because of their intimate knowledge and closeness to the challenges of gender equity in the workplace. The organisation used for this research has been a consistent recipient of awards for gender equity driven by the efforts and knowledge of PPC. In retrospect, this possibility should have been foreseen and it could possibly be ‘stacking the deck’ to have participation from an organisation where there is a high awareness of gender equity issues.

#### 5.4.1 Change in sample configuration

Omitting PPC participants from the sample creates a sub-set of data that is more representative of the general population within the professional services firm. The sub-set of data, excluding participants from PPC, provides stronger evidence to dismiss the null hypothesis. Associations between the independent and dependent variables are evident (Table 9, n = 60) and the null hypothesis is therefore rejected.

The alternative hypothesis: *in-group composition will be associated with gender bias* is accepted.

Table 9

*Pearson's correlations between independent and dependent variables, n = 60*

<b>Variable</b>	<b>IAT D score</b>	<b>OFS scale</b>	<b>MS scale</b>	<b>ass career</b>	<b>ass family</b>
Homogeneity	-0.25*	-0.18	-0.12	0.11	0.06
Trust	0.03	0.22*	-0.04	-0.12	-0.10
Size	-0.13	-0.28*	-0.17	-0.10	-0.35**

\* significant  $p \leq 0.05$  (1-tailed),

\*\*significant  $p \leq 0.01$  (1-tailed)

The tests for scale reliability have been repeated on this data sub-set and an updated table of descriptive statistics created (Table 12). The Cronbach's alpha score for the OFSS is 0.44. If question OFS5 is removed the Cronbach's alpha increases to 0.55. For males in the subset ( $n = 21$ ) the Cronbach's alpha is 0.69, indicating reasonable internal consistency; for females in the sample the Cronbach's alpha is 0.28, indicating a low level of consistency. Scores of 0.7 or above demonstrate good internal consistency within the scale. The complete scale will remain in the analysis but results need to be treated with caution because of the low level of internal consistency within the scale for females. This difference between males and females is consistent with the discussion in the literature review (Greenwald & Banaji, 1995; Hofmann et al., 2005). For example, males may tend to answer explicit overt bias questions more openly, and one's past experiences will also impact responses to explicit gender bias questions.

Table 10 lists the descriptive statistics for the OFSS.

Table 10  
Descriptive statistics for OFSS

Scale item	N	Minimum	Maximum	Mean	Std. Deviation
OFS1 capability	60	1	5	1.47	0.84
OFS2 boss	60	1	5	1.67	0.95
OFS3 sport	60	1	4	1.43	0.72
OFS4 logic	60	1	4	1.30	0.59
OFS5 carer	60	1	4	2.38	1.11

The Conbrach's alpha for the MS scale is 0.7 (males = .68, females = .68). This confirms a reasonable level of consistency within the MS scale for the data and the gender sub-groups within the data. If the question MS5 is removed (*People treat husbands and wives equally*) then the Conbrach's alpha score increases from 0.7 to 0.88. This question also correlated negatively with the other questions, so it was omitted from the analysis to provide a more reliable scale. Table 11 provides the descriptive statistics for the MS scale.

Table 11  
MSS descriptive statistics

Scale item	N	Minimum	Maximum	Mean	Std. Deviation
MS1 noproblem	58	1	5	1.88	0.84
MS2 anger	58	1	5	2.55	1.01
MS3 discriminate	58	1	5	2.97	0.97
MS4 sexismtv	58	1	5	2.10	1.04
MS5 spouseequal	58	1	5	3.38	1.15
MS6 equalops	58	1	5	2.45	1.14
MS7 concern	58	1	5	2.25	0.97
MS8 govtmedia	58	1	5	2.5	0.98

Table 12

*Descriptive statistics for variables N = 60 (all, male and female)*

Variable	All			Male			Female		
	N	Mean	*S.D.	N	Mean	S.D.	N	Mean	*S.D.
Homogeneity	60	59.25	16.66	21	61.86	17.93	39	57.85	16.00
Trust	60	8.25	0.93	21	8.26	0.87	39	8.25	0.97
In-group size	60	9.53	6.54	21	10.71	8.09	39	8.90	5.55
Implicit bias IAT D score	60	0.39	0.37	21	0.27	0.39	39	0.46	0.35
Associate female with career	59	4.69	1.21	21	4.62	0.92	38	4.74	1.35
Associate male with family	59	5.00	1.03	20	4.55	0.89	39	5.23	1.04
Old fashioned sexism scale	60	1.65	0.48	21	1.50	0.46	39	1.73	0.47
**Modern sexism scale	58	2.39	0.76	19	2.81	0.73	38	2.18	0.68

\*S.D. = standard deviation \*\*MS5 removed

## 5.5 Detailed data analysis and results

The primary hypothesis: *in-group composition will be associated with gender bias*, is now examined in more detail and results reported against each individual hypothesis.

### 5.5.1 H1. In-group composition in relation to the IAT D score

**Hypothesis 1.** In-group composition will be associated with implicit gender bias as per the sub-group hypotheses below.

**Hypothesis 1a.** In-group composition, as measured by the homogeneity score, will be negatively associated with implicit bias, as measured by the IAT D score.

**Result** A statistically significant negative association is confirmed between in-group composition, as measured by homogeneity, and implicit bias  $r = -0.25$ ,  $p = 0.03$ .

When the data is split by gender:

- males ( $n = 21$ ), no statistically significant associations.
- females ( $n = 39$ ), statistically significant association between the homogeneity score and implicit bias  $r = -0.36$ ,  $p = .01$

Therefore the hypothesis is accepted that: in-group composition as measured by homogeneity will be associated with implicit gender bias as measured by the IAT D score.

**Hypothesis 1b.** In-group composition as measured by trust, will have a positive association with implicit bias as measured by the IAT D score.

**Result** There is no association ( $r = 0.03$ ,  $p > 0.05$ ) between the in-group trust score and the IAT D score based on Pearson's correlation. When the data is split by gender:

- males  $r = 0.14$ ,  $p = > .05$ ,  $n = 21$
- females  $r = -0.13$ ,  $p = > .05$ ,  $n = 39$

Therefore the hypothesis is rejected.

**Hypothesis 1c.** In-group composition, as measured by size, will have a negative association with implicit bias as measured by the IAT D score.

**Result** There is no association ( $r = -0.13, p > .05$ ) between in-group size and the IAT D score based on Pearson's correlation. When the data is split by gender:

- males  $r = 0.01, p > 0.05, n = 21$
- females  $r = -0.20, p > 0.05, n = 39$

Therefore hypothesis 1c is rejected.

**Hypothesis 1d.** Implicit (unconscious) bias as measured by the IAT D score will be stronger when the first member of an in-group is male. The order in which a participant lists their in-group is suggested as an indicator of implicit bias; therefore, when a male is listed first it may suggest a stronger bias towards males and work.

**Result:** ( $N = 60$ ) Where the first member of in-group is male ( $n = 30$ ) the IAT D score mean = .46, where the first member of in-group is female ( $n = 30$ ) the IAT D score mean = .33, the difference in means based on the T-test is not statistically significant,  $p > .05$ .

At face value there appears to be a noticeable difference between means for the IAT D score when the first person of an in-group is male. However, there is not a statistically significant difference between means ( $p > .05$ ) therefore the null hypothesis is accepted and the hypothesis that: implicit (unconscious) bias as measured by the IAT D score will be stronger when the first member of an in-group is male is rejected.

### 5.5.2 H2. In-group composition in relation to explicit bias

**Hypothesis 2.** In-group composition will be associated with explicit gender bias, as per the sub-group hypotheses below.

**Hypothesis 2a.** In-group composition, as measured by the homogeneity score, will be negatively associated with explicit bias. An initial analysis shows no statistically significant associations between in-group composition as measured by homogeneity and the measures of explicit bias. A second analysis was undertaken splitting the sample by gender (males  $n = 21$ , females  $n = 39$ ).

For females ( $n = 39$ ), there is a statistically significant negative association between in-group composition, as measured by the homogeneity score, and explicit bias, as measured by the modern sexism scale,  $r = -0.35, p = 0.016$ . Therefore, homogeneity is negatively associated with the MSS as hypothesised, but only for females in the dataset. The other explicit scales (OFSS, ass career, asss family) show no statistically significant associations with trust.

**Hypothesis 2b.** In-group composition as measured by trust, will have a positive association with the explicit bias scales.

There is a statistically significant positive association between in-group composition as measured by trust and the old fashioned sexism scale,  $r = 0.22$ ,  $p = 0.04$ ,  $n = 60$ .

For males in the sample, there is a statistically significant negative association between in-group composition as measured by trust, and explicit bias as measured by association of gender with career (as the trust score increases the association of male with career decreases),  $r = -0.39$ ,  $p = 0.04$ ,  $n = 21$ .

For females in the sample, there is a statistically significant positive association between in-group composition as measured by trust, and explicit bias as measured by the old fashioned sexism scale,  $r = 0.27$ ,  $p = 0.04$ ,  $n = 39$ .

As hypothesised, there is a positive association between trust and the OFSS confirming the hypothesis. However, the association is positive for females and negative for males, a point that will be discussed in Chapter Six. The other explicit scales (MSS, ass career, ass family) show no statistically significant associations with trust.

**Hypothesis 2c.** In-group composition as measured by size, will have a negative association with explicit (conscious) bias as measured by the explicit bias scales.

There are statistically significant negative associations between in-group composition as measured by size and explicit measures of bias as follows:

- association of gender with family (as in-group size increases the association of male with family decreases)  $r = -0.35$ ,  $p = 0.03$ ,  $n = 60$
- the old fashioned sexism scale,  $r = -0.28$ ,  $p = 0.04$ ,  $n = 60$ .

For males in the sample, there is a statistically significant negative association between in-group composition as measured by size and association of gender with family (as in-group size increases the association of female with family decreases),  $r = -0.49$ ,  $p = 0.02$ ,  $n = 21$ . However there are no statistically significant associations ( $n = 21$ ) between size for the MSS ( $r = -0.17$ ,  $p > 0.05$ ), OFSS ( $r = -0.27$ ,  $p > 0.05$ ), and association of gender with career  $r = -0.10$ ,  $p > .05$ .



For females in the sample, there is a statistically significant negative association between in-group composition as measured by size and explicit bias as measured by the modern sexism scale,  $r = -.45, p < .01, n = 39$ .

The hypothesis that: in-group composition as measured by size will have a negative association with explicit (conscious) bias as measured by the explicit bias scales is partially confirmed. Statistically significant negative associations are as hypothesised between size and the OFSS ( $n = 60$ ), size and association of male with family (males only,  $n = 21$ ) and size and the MSS (females only,  $n = 39$ ).

### **5.5.3 H3. Implicit bias measure (IAT D score) in relation to explicit bias measures**

**Hypothesis 3.** Implicit bias, as measured by the IAT D score, will have a positive association with explicit bias as measured by the explicit bias scales used in this study.

Pearson's correlation has been used to measure the association between implicit bias, as measured by the IAT D score, and the explicit bias scales (OFS scale, MS scale, ass career, ass family) used in this study. The only statistically significant association between implicit bias as measured by the IAT D score and measures of explicit bias is for females in the data sub-set excluding PPC. For females, implicit bias as measured by the IAT D score has a statistically significant positive association with explicit bias as measured by the modern sexism scale,  $r = .45, p < .01, n = 39$ .

### **5.5.4 Supplementary analyses – explicit bias associations and multiple regression**

In relation to Hypothesis 1d and Hypothesis 3, additional analyses were carried out to test the association between the variables where the first person of the in-group is male (Table 13,  $n = 30$ ). The associations between the explicit bias variables have also been tested (Table 14,  $n = 60$ ).

Table 13

*Correlations between independent and dependent variables where first person in in-group is a male, n = 30 (all) n = 21 (females)*

Variables	IAT D score		ass career		ass family		OFS scale		MS scale	
	All	Female	All	Female	All	Female	All	Female	All	Female
homogeneity	-.39*	-.22	.17	-.10	-.14	-.17	-.40*	-.47*	-.11	-.53**
Trust	.08	-.04	-.12	.09	.24	.15	.34*	.30	.22	.29
Size	-.35*	-.17	-.16	-.16	-.50**	-.32	-.56**	-.59**	-.37*	-.57**

\*Statistically significant correlations  $p \leq .05$  (1-tailed)

\*\* Statistically significant correlations  $p \leq .01$  (1-tailed)

Note: male participants are not included in this table due to the small size of the data sub-set for male participants.

When the first person of an in-group is male the statistically significant associations between the variables of in-group composition and bias show stronger and more consistent patterns than for the whole sample ( $n = 60$ ). For example, where  $n = 60$  the only statistically significant association with homogeneity is the IAT D score and when first person in in-group is a male, homogeneity has statistically significant associations with the IAT D score, OFSS and MSS. Of particular interest are significant associations between all the variables of in-group composition and the explicit bias scales. This supports the notion that when the first person listed in in-group is male it is an indication of bias. These findings support earlier discussion relating to contextual factors playing a significant role in how bias manifests. In this case gender of the first person listed in in-group has a significant effect.

The explicit bias scales used in the study show correlations between each other (Table 14), consistent with findings in previous studies (Brauer et al., 2000; Swim et al., 1995).

Table 14

*Associations between the measures of explicit bias*

	All n = 60				Male n = 21				Female n = 39			
	ASS Career	ASS Family	OFSS	MSS	ASS Career	ASS Family	OFSS	MSS	ASS Career	ASS Family	OFSS	MSS
ASS Career	.	.32**	.18*	-.05	.	.53**	.28	-.08	.	.50**	.40**	.02
ASS Family	.32**	.	.18*	-.12	.53**	.	.61**	.27	.50**	.	.25	-.11
OFSS	.18*	.18*	.	.30**	.28	.61**	.	.09	.40**	.25	.	.39**
MSS	-.05	-.12	.30**	.	-.08	.27	.09	.	.02	-.11	.39**	.

\* Statistically significant correlations  $p \leq 0.05$  (1-tailed)\*\* Statistically significant correlations  $p \leq 0.01$  (1-tailed)

The next stage of the analysis explores the relationships between the variables using multiple regression. Regression models are used to test the extent to which the value of in-group composition and the participants' gender predict the value of:

- implicit bias, as measured by the IAT D score;
- explicit bias as measured by the modern sexism scale;
- explicit bias as measured by the old fashioned sexism scale; and
- explicit bias as measured by association of gender with career and family.

For each regression model the histogram and normal probability plots were visually inspected to check homoscedasticity and that residuals were normally distributed for the dependent variable. Analysis was carried out starting with the data set  $n = 60$ . The data set was split by gender when the ANOVA multiple correlation coefficient only reported a statistically significant result for gender. This allows for regression analysis of male and female data sub-sets separately where associations exist at the gender sub-set level.

**Results: in-group composition – implicit bias as measured by the IAT D score.** For the sub-set of data comprising females ( $n = 39$ ), the multiple regression model statistically significantly predicted implicit bias as measured by the IAT D score  $F(3,35) = 3.28, p = 0.03, \text{adj } R^2 = 15.2\%$ . The homogeneity variable is the only variable that added statistically significantly to the prediction. Regression coefficients and standard errors can be found in Table 15.

Table 15

*Implicit bias regression, females,  $n = 39$*

Variable	$B$	$SE_B$	$\beta$
Intercept	1.68	0.53	
Homogeneity	-0.01	0.003	-0.41
Trust	-0.01	0.06	-0.19
Size	-0.01	0.01	-0.22

$p \leq 0.05$ ;  $B$  = unstandardised regression coefficient;  $SE_B$  = standard error of the coefficient;  $\beta$  = standardised coefficient.

**Results: in-group composition – explicit bias as measured by association of gender with family (ass family),  $n = 60$ .** The multiple regression model statistically significantly predicted explicit bias as measured by ass family  $F(4,54) = 3.51, p = .007, \text{adj } R^2 = 16.9\%$ . In-group size and gender are the only two variables that added statistically significantly to the prediction. Regression coefficients and standard errors can be found in Table 16.

Table 16

*Ass family regression,  $n = 60$*

Variable	$B$	$SE_B$	$\beta$
Intercept	2.93	1.38	
Homogeneity	0.01	0.15	0.15
Trust	0.12	0.10	-0.10
Size	-0.05	0.02	-0.33
Gender	0.63	0.26	0.29

$p \leq 0.05$ ;  $B$  = unstandardised regression coefficient;  $SE_B$  = standard error of the coefficient;  $\beta$  = standardised coefficient.

**Results: in-group composition – explicit bias as measured by association of gender with career (ass career).** The multiple regression model does statistically significantly predict ass career,  $p > 0.05$ .

**Results: in-group composition – explicit bias as measured by the old fashioned sexism scale (OFSS).** Homogeneity, trust, and size combine to statistically significantly predict the OFSS,  $F(4,55) = 2.92, p = 0.03, \text{adj } R^2 = 11.5\%$ . However, a review of coefficients shows the individual variables do not add statistically significantly to the prediction. Regression coefficients and standard errors can be found in Table 17;  $p > 0.05$ ; therefore the regression model does not statistically predict explicit bias as measured by the OFSS. This is consistent with findings in the literature and earlier analysis that demonstrated the low level of internal consistency for the OFSS.

Table 17

*OFSS regression , n = 60*

Variable	<i>B</i>	<i>SE<sub>B</sub></i>	$\beta$
Intercept	0.82	0.65	
Homogeneity	-0.003	0.004	-0.11
Trust	0.10	0.20	0.20
Size	-0.02	-0.23	-0.23
Gender	0.20	0.12	0.20

$p > 0.05$ ; *B* = unstandardised regression coefficient; *SE<sub>B</sub>* = standard error of the coefficient;  $\beta$  = standardised coefficient.

**Results: in-group composition – explicit bias as measured by the modern sexism scale (MSS), n = 60.** The multiple regression model statistically significantly predicted explicit bias as measured by MSS,  $F(4,53) = 1.88$ ,  $p = 0.007$ , adj  $R^2 = 17.3\%$ . The gender variable is the only variable that added statistically significantly to the prediction. Regression coefficients and standard errors can be found in Table 18.

Table 18

*MSS regression , n = 60*

Variable	<i>B</i>	<i>SE<sub>B</sub></i>	$\beta$
Intercept	4.61	0.99	
Homogeneity	-0.01	0.01	-0.16
Trust	0.05	0.10	-0.06
Size	-0.02	0.01	-0.21
Gender	-0.70	0.20	-0.44

$p \leq 0.05$ ; *B* = unstandardised regression coefficient; *SE<sub>B</sub>* = standard error of the coefficient;  $\beta$  = standardised coefficient.

As participant's gender is the significant predictor in the model, the data has also been split by participant gender to assess the statistical significance of other components of the model for males and females.

For males the multiple regression model does not statistically significantly predict the MSS,  $p > 0.05$ .

For females ( $n = 39$ ) the multiple regression model statistically significantly predicted explicit bias as measured by MSS,  $F(3,35) = 1.957$ ,  $p = 0.003$ ,  $\text{adj } R^2 = 27.4\%$ . Homogeneity and size added statistically significantly to the prediction. Regression coefficients and standard errors can be found in Table 19.

Table 19

*MSS regression,  $n = 60$*

Variable	$B$	$SE_B$	$\beta$
Intercept	4.31	0.95	
Homogeneity	-0.02	0.01	-0.39
Trust	-0.08	0.01	-0.12
Size	-0.05	0.02	-0.44

$p \leq 0.05$ ;  $B$  = unstandardised regression coefficient;  $SE_B$  = standard error of the coefficient;  $\beta$  = standardised coefficient.

In summary, initial analysis was disappointing due to the influence in the data of a significant group tasked with addressing gender and equity issues. Once the sample was refined, statistically significant associations and causal relationships have been reported in the analysis. The detailed analysis has examined associations between in-group composition and measures of implicit and explicit bias. The associations reported and are now discussed in Chapter six.

## 6 Discussion

The discussion of the results begins with reflections on aspects of the study that may have affected responses. The composition of in-group is discussed and how that may influence gender bias, and the relationship between the bias scales is discussed. Finally, the implications for practice from a CAS perspective are considered.

### 6.1 General observations

The initial analysis of the data did not provide statistically significant associations between the variables. This was attributed to a bias in the sample itself caused by a relatively large group of Human Resource (HR) practitioners (47% of sample) who participated in the study and the high awareness of gender issues in the participants' organisation. When the HR bias was removed associations between in-group composition and bias was evident.

This HR response bias in the survey is one of a number of indications that context, knowledge, and relationships affect the way in which participants respond to measures of gender bias. The other factors that possibly affected the way in which participants responded to the implicit and explicit measures are: participant gender, the number of connections one has (size of in-group), the gender of the first person someone intuitively thinks of, and the proportion of males and females in their in-group (homogeneity). The relationships between these factors are not linear and they seem to interact with each other in unexpected ways, exemplifying the complex nature of gender bias. This means that the associations between the same variables are not only statistically different depending on the contextual factors involved, but different associations show up. When examining the unexpected difference in male and female implicit bias responses Greenwald and colleagues (2002) describe a network of variable-strength associations among person concepts (self and groups) and contextual attributes that are consistent with the data dynamics of this study.

The other factor that is important to note when observing gender bias in organisations is the extent to which the traditional statistical analysis in a study of this design can obscure potential issues. For instance, in this study three senior partners in the firm recorded bias scores at the extremes. These people have whole teams



reporting to them so the impact they may have is felt widely. It would require a different study design to capture this dimension.

## 6.2 In group composition and gender bias

Central to this study is the notion in-group composition has an association with gender bias. Previous research examined in the literature (e.g., Greenwald et al., 2002; Rudman & Goodwin 2004) has highlighted gender differences in implicit in-group bias. Of interest is how the composition of in-group interacts with these gender differences. This is discussed considering each of the variables of in-group composition (homogeneity, trust, and size) and participant gender.

**Homogeneity:** In-group homogeneity has different levels of association with both implicit bias (as measured by the IAT D score) and explicit bias (as measured by OFSS, MSS, ass career, ass family) based on the participant's gender. Associations between homogeneity and implicit bias associations are: combined gender groups,  $r = -0.25$ ,  $p = 0.03$ ; for females in the study the associations are stronger ( $r = -0.36$ ,  $p = 0.01$ ) and for males the statistical associations are not significant ( $r = -0.04$ ,  $p > 0.05$ ). The only statistically significant association between homogeneity and explicit bias is for female's MSS responses,  $r = -0.35$ ,  $p = 0.016$ . For comparison, males' response to the MSS was  $r = 0.07$ ,  $p > 0.05$ .

A similar pattern, when responses are split by gender, can be observed when comparing the statistically significant responses for males and females between the two other measures of in-group composition, trust, and size, and measures of explicit bias.

**Trust:** For females there is a statistically significant positive correlation with OFSS,  $r = 0.27$ ,  $p = 0.04$  (this needs to be held lightly as OFSS lacks internal consistency for females in this data set); for males there is a statistically significant negative correlation with ass career (as trust increases the explicit association of male with career decreases),  $r = -0.39$ ,  $p = 0.04$ . This is interesting, based on these results explicit bias increases for females as trust increases and vice versa for males, as trust increase explicit bias decreases.

In-group members tend to be more trusted and thought about in deeper ways than others (Brewer 1999: Van Bavel, 2008). In the sub-set of data where a male was the first member of in-group ( $n = 30$ ), trust showed a statistically significant negative correlation with the OFSS. In other words, a higher level of trust was associated with

lower explicit bias as measured by the OFSS (the OFSS scale also shows greater reliability for this sub-set of data). This may hint that trust is a necessary component of lower levels of bias and may also suggest that where trust is high in a person's in-group they are more likely to express their gender views explicitly.

**Size:** For females there is a statistically significant negative correlation with MSS,  $r = -0.43$ ,  $p = 0.003$ ; for males  $r = -0.005$ ,  $p > 0.05$ . Males record a statistically significant negative correlation between size and association of family with female (as in-group size increases explicit association of female with family decreases),  $r = -0.48$ ,  $p = 0.02$ . In both of these examples the explicit bias scales are moving in the same direction.

The relationships discussed so far emerged from the analysis of hypotheses 1 and 2. The supplementary analysis threw up additional food for thought when the first person in in-group is male. The rationale behind this analysis is that the gender of the person one intuitively lists first as a member of their work in-group could be an indication of bias. Where first person listed in the in-group is a male, statistically significant negative associations between in-group composition and the IAT D score, OFSS, and MSS are reported (Table 13). These scales also appear to be moving together in the same direction for this data sub-set.

The apparent transparency and consistency between the measures supports the suggestion that the gender of the person listed first in in-group is an indicator of bias. It seems it may also be an indicator of a participant's comfort in responding openly to the old fashioned sexism scale with less effort being made to control overt responses.

There are also weak signals in the data ( $n = 60$ ) when it is split by gender that suggest opposite statistical trends for gender bias in relation to movements in the variables of in-group composition. For example, an increase in homogeneity for females has a negative association to subtle sexism (as measured by MSS), whereas for males it may be the opposite, and similarly for implicit bias. This has implications for how gender bias is approached and may suggest that gender-specific strategies are appropriate. This notion is made more complex when the gender of the person thought of first when compiling one's in-group is included in the model. Where that person is a male the gender bias tendencies are stronger and consistent across both implicit and explicit measures.

In summary, the composition of in-group as well as other factors may affect the manifestation of in-group bias. The factors that seem to have the greatest association include the gender of who first springs to mind, one's own gender, the size of the in-group, and the homogeneity of the in-group. The signs shown in the regression analysis that identify potential causal links between in-group composition and gender bias, support the proposition that in-group composition could provide a useful construct for thinking about how gender bias is addressed within an organisational context. The regression analysis confirms the potential influence of one's gender and, size and homogeneity of one's in-group, on gender bias. This study also confirms that males and females respond quite differently to implicit and explicit measures of gender bias.

### **6.3 Relationships between bias scales**

Participant gender plays a key role throughout the study, with multiple regression analysis identifying gender as having the greatest effect on the IAT D score and MSS. The statistical analysis in this study also demonstrates that implicit and explicit measures are likely measuring quite different constructs but that there are also circumstances where the measures align and the scales move together in the same direction; for example, the data-set where the first person of the in-group is male.

A range of differences in responses to the measures used in the study is evident and the reliability of some scales also seems to be very contextual. For example, Cronbach's alpha for OFSS is 0.28 for females ( $n = 39$ ) and 0.69 for males ( $n = 21$ ), yet for females who list a male first in their in-group the Cronbach's alpha increases to 0.6,  $n = 21$ . Another interesting observation is that there is no direct association between the extent to which gender is explicitly associated with career and family (ass career and ass family) and the IAT D score. This lack of association is despite these questions essentially explicitly asking the same questions that the IAT asks implicitly. These questions do show associations with the OFSS and MSS (Table 14). MSS also has a statistically significant association with the IAT  $r = 0.45$ ,  $p = 0.002$ , females,  $n = 39$ . This illustrates the complexity involved in measuring gender bias and why multiple measures are necessary to get a sense of the gender dynamics.

In summary, these findings are consistent with the literature. For example, Hofmann and colleagues (2005) found in their meta study that a range of factors affected the extent to which implicit and explicit measures correlated with each other. Each one of the data sets analysed to some extent represents a different set of factors.

#### **6.4 Complex adaptive systems**

The discussion so far confirms the complex nature of bias with a range of factors affecting and/or cueing participants' responses. These factors include the composition of their in-group, organisational norms and systems; the experience itself and how they have individually reacted; which stereotypes have been activated during the exercise; the cognitive resources they have had available; the extent to which gender is a salient topic; and how the factors of spontaneity, social desirability, and introspection have played out while completing the measures.

The factors involved, and bottom-up and top-down inputs demonstrate the value of Free & Ambady's (2011) model of personal construal (Figure 3) and Molenberghs' (2013) summary of the brain regions involved in modulating group relationships (Figure 4). These models help to make sense of the web of inter-related contextual and cognitive factors involved in bias when viewed through a complex adaptive systems lens.

The dynamics that are described in the literature, and playing out in this study, can be described in CAS terms. This is useful, as it makes object the patterns of the system (the patterns can be seen) and identifies potential areas that provide opportunities to experiment and nudge the system to learn, as well as take it in the desired direction. Gender bias is an emergent property of the gender system and emergent properties have their origin in the patterns formed from the lowest level of recurrence in the system. Social cognitive neuroscience provides insight into these low-level patterns and the recurrence of the patterns at different levels. The levels could be in this order: the connections in one's brain, the interactions between brain networks, neuron and mirror neuron dynamics between individuals and groups, the characteristics of relationships (including categorisation), the characteristics of in-groups and out-groups, and the way we interact within groups and the organisation.

This description is consistent with Freeman & Ambady's (2011) model of personal construal (Figure 3) and informed by the other neuroscience literature reviewed. The feedback loops and rules present within the systems at the various

levels of recurrence can enable change to occur or reinforce the status quo. Social cognitive neuroscience provides a unique window into the system and both builds understanding of gender bias as well as informing possible approaches to shift the gender system by contributing to designing experiments and interventions at different levels of recurrence.

A dynamic systems model of gender bias has been developed as part of this discussion (Figure 6). This model attempts to illustrate the properties of a CAS by highlighting feedback loops and inter-connected ‘agents’ that influence each other in continuous and dynamic patterns. It shows the complexity of the gender system; although to truly show the complexity is impossible in a one dimensional picture. The model begins to provide clues to better understand the current system dynamics, identify opportunities to experiment to understand the system better whilst possibly also moving the system in a desired direction (Berger & Johnston, 2015). The full implications of this model from a practical standpoint are discussed in Chapter Seven.

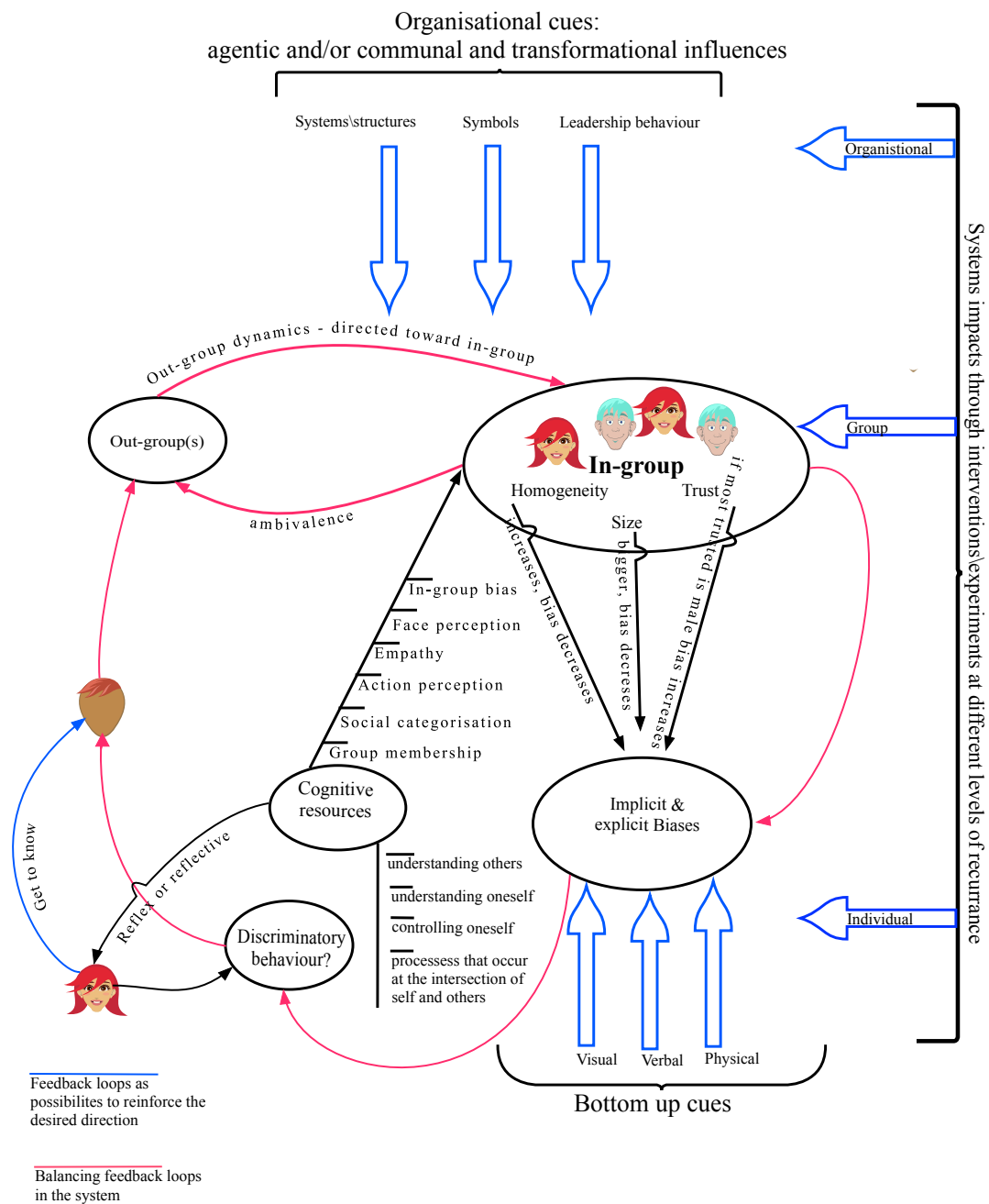


Figure 6. Dynamic systems model of gender bias

## 7 Conclusions

The central proposition underlying this research is that the gender composition of a person's in-group; that is, the group of people one most closely relates to, has implications for their level of gender bias. The aims of this study are to answer the following question and sub-questions:

*To what extent does the composition of in-group associate with gender bias?*

- *To what extent does the composition of in-group associate with implicit (unconscious) gender bias?*
- *To what extent does the composition of in-group associate with explicit (conscious) gender bias?*
- *How can complex adaptive systems inform understanding of gender bias?*

The research demonstrated a statistically significant association between in-group composition and the manifestation of implicit and explicit bias for some, but not all, measures applied in this study.

### 7.1 Research implications

This study was based on the interaction of three key constructs (in-group composition, implicit bias, explicit bias) and nine variables. This is an oversimplification of the gender system but even so, the statistical dynamics that have emerged from this study illustrate the complexity of the topic. The study confirms existing knowledge about the inter-relationships between measures of gender bias: that there are contexts where implicit measures, subtle measures, and overt measures will align and appear to be measuring related constructs, and other contexts when they will not appear to be related.

If people are generally aware of their implicit gender bias it is not always reflected in the way in which they answer questions relating to explicit bias and this differs for males and females. Females may understand subtle sexism better than males and their scores on the MS scale associated strongly with implicit bias as measured by the IAT D score; possibly subtle sexism is a blind spot for males. At the same time no clear association was found between the explicit questions (association with career/family) that probed the same relationships as the IAT.

Males recorded lower implicit bias than females, although they are the dominant group. As discussed earlier in this thesis, this is consistent with previous research and

attributed to the unique relationship between males and females and evolutionary gender roles. These deep evolutionary tendencies may also be what makes subtle gender bias salient from a female perspective, as it no longer serves females in the modern context. Based on the relationships between the IAT and the explicit measures it seems people are often unaware of their explicit gender biases or tend to answer explicit questions in a socially desirable way, or both.

The study has also added to the knowledge of in-group and out-group dynamics. It is clear that in-group composition has an association with both implicit bias as measured by the IAT D score and the explicit scales used. This has been reinforced by regression analysis that suggests in-group composition could be developed as a predictor of bias. Applying CAS approaches means that knowledge of in-group composition and the bias patterns that emerge provide the opportunity to generate experiments to test understanding of group dynamics and changes that may move the system in a desired direction.

The results are influenced by other factors; for example, gender of first person listed in in-group. No single set of rules can be applied but patterns are evident. The relationship between in-group composition and measures of gender bias appears to be most influenced by size, homogeneity, and one's own gender. The career:family IAT and measures of explicit bias have different statistical associations depending on the sub-set of data and inter-relationships within the data, including in-group composition. This is consistent with previous meta studies (Hofmann et al., 2005; Greenwald et al., 2009). It highlights that implicit and explicit bias are different constructs and that although modern sexism and implicit bias have some similarities, they are not the same.

In summary, this study adds to the knowledge of how different measures and constructs of bias interact. It confirms findings from previous studies that at times implicit and explicit scales move together in the same direction and at other times associations may be different. Different results in the relationship between scales may arise based on context, in-group composition, and the group categories in play. The study also puts forward a model of in-group composition that could be developed



further as a means to predict gender bias and become the foundation from which to develop appropriate experiments<sup>9</sup> to test those predictions.

## 7.2 Implications for practice

The neuroscience literature highlights that the link between group membership and in-group bias and behaviour involves a range of cognitive processes summarised by Molenberghs (2013) (Figure 4). These cognitive processes respond to contextual bottom up and top down cues as illustrated by Freeman & Ambady's (2011) model of person construal (Figure 5). This study has endeavoured to bring these neuroscience and complexity ideas together in a systems model for gender bias that is also informed by the research undertaken (Figure 6). The study adds to the systemic knowledge of gender bias and application of CAS to practice by providing a model to interpret the dynamics of the gender system in an organisation, and identify opportunities to address gender issues at different levels of recurrence. Bringing together the disciplines from neuroscience and CAS to address gender bias potentially has considerable value. Neuroscience provides a unique perspective on the patterns at the lowest level of the system that recur at higher levels, while CAS ideas enable constructs to be created to model existing dynamics, identify areas for experimentation, and model potential changes.

For professional services firms specifically, this study provides insight into the dynamics that emerge from the composition in-group. Flags to be aware of are the size of in-groups (make them bigger and encourage connections), the level of homogeneity (encourage cross functional teams and disrupt traditional groups), the extent to which males are closest confidant (encourage people to get diversity of views), and that one's own gender is a key influence of in-group dynamics (educate people about gender dynamics from a neuroscience and CAS perspective and encourage reflection on how that plays out for themselves). Males and females experience in-group bias in different ways and, based on responses to the modern sexism scale, males may have blind spots. At the same time, females may influence

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<sup>9</sup> An experiment in this context does not mean a pure scientific approach – it means trying things out within safe boundaries to see how the system responds in an effort to learn, rather than solve.

the gender system in ways they are unaware of because of their tendency towards higher levels of implicit bias than males.

Progress with gender bias will be made when it is tackled in an oblique fashion that influences the system long term. Head-on approaches will tend to make gender a salient category, taking priority over other group categories and triggering bias and backlash. A more effective approach is to ‘play’ with organisational systems such as recruitment, promotion, pay, performance, and the way work is organised and measured to nudge gender bias indirectly. Examples of possible opportunities to nudge the system are listed below (Table 20). A number of the examples listed should be approached at the same time.

Each of these suggestions provides fertile ground for small granular experiments that enable individuals, groups, and organisations to learn about the gender system without gender equality being overtly enforced.

Overlaying potential experiments with knowledge from neuroscience and CAS allows leaders and others in the system to gain insight to themselves as well as dynamics at higher levels of recurrence. A dynamic systems model of gender bias allows people to see potential feedback loops and attractor states in the gender system and how they individually and collectively respond to small changes. This means that individual, group, and organisational learning is more likely to occur through conscious awareness of the dynamics within and around us.

Table 20

*Opportunities to nudge the gender system.*

Opportunity	Organisational level		
	Individual	Group	Organisation
Using different criteria that describes success\competence (e.g. try out agentic, communal, transformational competency combinations).			✓
Try out structures and accountabilities that encourage working across the organisation.		✓	✓
Make gender statistics available in novel ways and increase transparency of gender issues.			✓
Using internal and external role models (e.g. at corporate events).		✓	✓
Divesting power – encouraging collaborative decision making and problem solving.	✓	✓	✓
Encouraging groups to form around activities rather than vertical structures.		✓	✓
Put mentoring programmes in place.	✓	✓	
Introduce perspective taking and diversity education as key elements to induction.	✓	✓	✓
Regular exposure to novel areas of work.	✓	✓	
Education (e.g. voluntary training on basic neuroscience and complexity ideas; linking diversity ideas to personal and professional development).	✓		
Participation in action research and novel ways of working.	✓		
Raising awareness of the nature of bias from different perspectives and how oneself may reinforce or change the system (e.g. contrast gender differences in the experience of benevolent sexism).	✓		

### 7.3 Limitations

This study has several limitations:

**In-group composition:** The measures of in-group composition were developed for this study. Homogeneity and size provided consistent associations with the dependent variables whereas trust did not. As a first attempt at measuring in-group composition this has worked well but also highlighted potential shortcomings with the construction of the trust measure.

**Composition of participants:** Although the participants were in the ‘real world’, they were also quite a homogeneous group from one professional services firm. The sample was also biased by a high percentage (47%) of HR practitioners who were omitted from analysis.

**Social desirability:** The study would have benefitted from inclusion of a social desirability scale to test the explicit bias responses. This may have enabled the responses from the HR group to be included.

**Cueing of participants:** The study relied on the survey design to minimise cueing. The email that distributed the link to the survey may have cued people for the topic of gender bias and may have undermined the survey to some extent. This highlights the difficulty and importance of researchers maintaining the integrity of studies involving real-world organisations.

**Sample size:** The size of the sample met statistical thresholds. However, it was not sufficiently large to facilitate reliable use of demographic factors other than gender. Although males make up 50% of the participant organisation, they only accounted for 25% of the valid participant records. The results for males showed some interesting patterns that lacked statistical significance and that maybe resolved by more males being included.

### 7.4 Avenues for future research

Possible avenues of future research include developing the measures used for in-group composition and extending the scope of this study. Firstly, the measures of in-group composition used in this study would benefit from further development, particularly the notion of trust. Secondly, the scope of enquiry could be extended on two fronts: 1) capturing a larger and more diverse sample from multiple organisations and/or contexts, enabling the hypothesised relationships to be examined more reliably for males as well as investigating the impact of other demographic variables, and 2)

extending the research tools to include stories of participants' experiences that could be evaluated against the statistical data to better understand how the measurement of gender bias and in-group/out-group dynamics relates to behaviour in organisations.

In closing, this research has demonstrated the value of integration across diverse disciplines – in this case: social cognitive neuroscience and complex adaptive systems theory – as a means to create insights and open new avenues of study on intractable organisational issues.

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## Appendix 1: Survey design encoding of variables

## Coding table

Wikibooks.org (2013)

<b>Introduction</b>
<i>Thank you for taking the time to participate in this research study – your participation is much appreciated.</i>
<i>The purpose of this survey is to explore the relationship between the make of groups in an organisation and the dynamics that emerge. The study consists of three separate surveys. As you enter each survey a brief explanation will be provided. Please be open with your answers. All information you provide will be strictly confidential. Furthermore, your responses are anonymous. There is no need to identify yourself. The information provided is for academic research sponsored by Victoria University of Wellington. Results of the survey and ideas that have been gathered from other sources will be used to inform the research and develop initiatives. A summary report and recommendations will be provided to KPMG and also be available to you.</i>
<i>If you have any questions or concerns please contact me <a href="mailto:James.Wicks@VUW.ac.nz">James.Wicks@VUW.ac.nz</a></i>

### Section 1 – Gender:Career IAT (standard instructions)

'Variable #'	Item #	'Variable label'	Coding	Type of variable
<i>Section 2 – Questionnaire. An important aspect of this research is understanding who as a professional is in your in-group. "In-group" comprises those people who you intuitively trust. For example, often in professional life we come across challenges that stymie us, situations in which we seek the insights and opinions of others. The people we turn to in these situations are members of your in-group for the purposes of this study.</i>				
<i>On a bit of paper briefly brainstorm as many of those people over the course of your professional career to whom you have been comfortable seeking advice or confiding in – the people you tend to gravitate towards in your professional life. Without changing the order of that list or revealing who these people are please complete the following table. The table asks for some broad details as well as the degree to which you implicitly trust and value their opinion on a scale of 1 to 10 where 1 = somewhat and 10 = absolute trust and highly value their opinion.</i>				

**Table**

Number (pre- numbered) 1 -30	Approximate age 1 = Under 25 years 2 = 25 – 34 years 3 = 35 – 44 years 4 = 45 – 54 years 5 = 55 years and above	Professions (leave blank if unknown)	Gender	Degree to which their opinion is trusted and valued.  Enter a value between 1 and 10 where 1 = somewhat trusted and 10 = absolute trust and highly valued.
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Section 3a – Questionnaire. This final questionnaire is seeking your views on a range of questions. The first two questions relate to the first survey you completed, the Gender:Career perspectives.				
31	3.1	AssCareer	How strongly do you associate career with males and females?	Ordinal
32	3.2	AssFamily	How strongly do you associate family with males and females?	Ordinal
Section 3b – The next questions are a series of statements designed to prompt a reaction. Some statements may seem strongly worded or a little unusual. Please go with your first reaction when answering and answer all the questions by indicating the extent to which you agree or disagree with the statement.				
33	3.3	Capability	Women are generally not as capable as men in our workplace 1=strongly disagree, 2=disagree, 3= neither agree or disagree, 4=agree, 5=disagree	Ordinal
34	3.4	Boss	I would be equally comfortable having a woman as a boss as a man 1=strongly disagree, 2=disagree, 3= neither agree or disagree, 4=agree, 5=disagree	Ordinal
35	3.5	Sport	It is more important to encourage boys than to encourage girls to participate in athletics 1=strongly disagree, 2=disagree, 3= neither agree or disagree, 4=agree, 5=disagree	Ordinal
36	3.6	Logic	Women are just as capable of thinking logically as men 1=strongly disagree, 2=disagree, 3= neither agree or disagree, 4=agree, 5=disagree	Ordinal
37	3.7	Carer	When both parents are employed and their child gets sick at school, the school should call the mother rather than the father 1=strongly disagree, 2=disagree, 3= neither agree or disagree, 4=agree, 5=disagree	Ordinal
38	3.8	NoProblem	Discrimination against women is no longer a problem in Australia	Ordinal

			1=strongly disagree, 2=disagree, 3= neither agree or disagree, 4=agree, 5=disagree	
39	3.9	Anger	It is easy to understand the anger of women's groups in Australia 1=strongly disagree, 2=disagree, 3= neither agree or disagree, 4=agree, 5=disagree	Ordinal
40	3.10	Discriminate	Women often miss out on good jobs due to sexual discrimination 1=strongly disagree, 2=disagree, 3= neither agree or disagree, 4=agree, 5=disagree	Ordinal
41	3.11	SexismTV	It is rare to see women treated in a sexist manner on television 1=strongly disagree, 2=disagree, 3= neither agree or disagree, 4=agree, 5=disagree	Ordinal
42	3.12	SpouseEqual	On average, people in our society treat husbands and wives (or male and female partners) equally 1=strongly disagree, 2=disagree, 3= neither agree or disagree, 4=agree, 5=disagree	Ordinal
43	3.13	EqualOps	Society has reached the point where women and men have equal opportunities for achievement 1=strongly disagree, 2=disagree, 3= neither agree or disagree, 4=agree, 5=disagree	Ordinal
27	3.14	Concern	It is easy to understand why women's groups are still concerned about societal limitations of women's opportunities 1=strongly disagree, 2=disagree, 3= neither agree or disagree, 4=agree, 5=disagree	Ordinal
28	3.15	GovtMedia	Over the past few years, the government and news media have been showing more concern about the treatment of women than is warranted by women's actual experiences 1=strongly disagree, 2=disagree, 3= neither agree or disagree, 4=agree, 5=disagree	Ordinal

'Variable #'	Item #	'Variable label'	Coding	Type of variable
Section 4 – Finally please provide us some details. This information is collected to help with analysis and enable us to compare data with similar studies that have been carried out in the past. Please complete all questions.				
Please complete all questions – this information is used for analysis purposes only				
1	4.1	Service	What part of KPMG do you work in? 1 = CFO Advisory 2 = People, Performance & Culture 3 = Risk Management	Nominal



			4 = Private Enterprise 5 = Markets & Growth 6 = Tax	
2	4.2	State	What state do you mostly work in? 1 = Act 2 = NSW 3 = QLD 4 = SA 5 = VIC 6 = WA	Nominal
3	4.3	Job Title	What is your role? 1= Partner/Executive Director 2 = Director 3 = Associate Director/Senior Manager 4 = Manager/Senior Executive 5 = Assistant Manager/Executive/Senior Accountant/Adviser/Senior Consultant 6 = Executive/Analyst/Accountant/Consultant 7 = Undergraduate/Assistant Accountant 8 = Team member/Senior Team member	Nominal
4	4.4	TimeOgr [Years Service]	How long have you been at KPMG? 1 = Less than 1 year 2 = 1 year – less than 3 years 3 = 3 years – less than 5 years 4 = 5 years – less than 10 years 5 = 10 years – less than 15 years 6 = 15 years or more	Nominal

5	4.5	Age	How old are you? 1 = Under 25 years 2 = 25 – 34 years 3 = 35 – 44 years 4 = 45 – 54 years 5 = 55 years and above	Nominal (continuous)
6	4.6	Ethnicity	What ethnicity are you? 1 = South Asian (Indian subcontinent) 2 = East Asia (e.g., China, Japan, Korea, Thailand etc.) 3 = Aboriginal and/or Torres Strait Islander 4 = Black African/Black Caribbean/Black other 5 = Middle Eastern 6 = Pacific Islander 7 = White/Caucasian/European 8 = Hispanic/Latino 9 = Mixed ethnic heritage 10 = Other	Nominal
7	4.7	Gender	What gender are you? 1 = Female 2 = Male	Nominal

**In closing .....**

*The answers you have provided will be collated with the other responses received to the survey. The results will add to our understanding of how the make up of groups may impact the dynamics within an organisation. Thank you for taking the time to participate in this research study – your participation is much appreciated.*

*If you have any questions or concerns please contact me [James.Wicks@VUW.ac.nz](mailto:James.Wicks@VUW.ac.nz)*

## Coding confirmation: Project Implicit

Variable Codebook for: Contract.Wicks.Gender2015

For all items

- if a numerical value (e.g., value="1") is not defined for a given response option, the response will be recorded as the text that appeared on the response button (e.g., Slightly Agree).

----- Section 2 -----

For each person the participant lists, there are four variables that use the following format:

1age

<option value="1">Under 25 years</option>

<option value="2">25 - 34 years</option>

<option value="3">35 - 44 years</option>

<option value="4">45 - 54 years</option>

<option value="5">55 years and above</option>

1prof

opentext response

1gender

<option value="1">Male</option>

<option value="2">Female</option>

1trust

```
<option value="1">1 = Somewhat trusted</option>
<option value="2">2</option>
<option value="3">3</option>
<option value="4">4</option>
<option value="5">5</option>
<option value="6">6</option>
<option value="7">7</option>
<option value="8">8</option>
<option value="9">9</option>
<option value="10">10 = Absolute trust and highly valued</option>
```

Variables continue for all 30 -- 2age, 2profession, etc.

-----Section 3-----

```
name: 'AssCareer',
stem: "How strongly do you associate <u>career</u> with males and females?",
answers: [
  {text: 'Strongly male', value:7},
  {text:'Moderately male', value:6},
  {text:'Slightly male', value:5},
  {text:'Neither male nor female', value:4},
  {text: 'Slightly female', value:3},
  {text:'Moderately female', value:2},
  {text: 'Strongly female', value:1}
```

```
name: 'AssFamily',
stem: "How strongly do you associate <u>family</u> with males and females?",
  answers: [
    {text: 'Strongly male', value:7},
    {text:'Moderately male', value:6},
    {text:'Slightly male', value:5},
    {text:'Neither male nor female', value:4},
    {text: 'Slightly female', value:3},
    {text:'Moderately female', value:2},
    {text: 'Strongly female', value:1}
```

```
name: 'Capability',
stem: "Women are generally not as capable as men in our workplace",
  answers: [
    {text: 'Strongly Agree', value:5},
    {text:'Agree', value:4},
    {text:'Neutral', value:3},
    {text:'Disagree', value:2},
    {text: 'Strongly Disagree', value:1}
```

name: 'Boss',

stem: "I would be equally comfortable having a woman as a boss as a man",

answers: [

{text: 'Strongly Agree', value:5},

{text:'Agree', value:4},

{text:'Neutral', value:3},

{text:'Disagree', value:2},

{text: 'Strongly Disagree', value:1}

name: 'Sport',

stem: "It is more important to encourage boys than to encourage girls to participate in athletics",

answers: [

{text: 'Strongly Agree', value:5},

{text:'Agree', value:4},

{text:'Neutral', value:3},

{text:'Disagree', value:2},

{text: 'Strongly Disagree', value:1}

name: 'Logic',

stem: "Women are just as capable of thinking logically as men",

answers: [

{text: 'Strongly Agree', value:5},

{text:'Agree', value:4},

{text:'Neutral', value:3},

{text:'Disagree', value:2},

{text: 'Strongly Disagree', value:1}

name: 'Carer',

stem: "When both parents are employed and their child gets sick at school, the school should call the mother rather than the father",

answers: [

{text: 'Strongly Agree', value:5},

{text:'Agree', value:4},

{text:'Neutral', value:3},

{text:'Disagree', value:2},

{text: 'Strongly Disagree', value:1}

name: 'NoProblem',

stem: "Discrimination against women is no longer a problem in Australia",

answers: [

{text: 'Strongly Agree', value:5},

{text:'Agree', value:4},

{text:'Neutral', value:3},

{text:'Disagree', value:2},

{text: 'Strongly Disagree', value:1}



```
    name: 'Anger',  
    stem: "It is easy to understand the anger of women's groups in Australia",  
    answers: [  
      {text: 'Strongly Agree', value:5},  
      {text:'Agree', value:4},  
      {text:'Neutral', value:3},  
      {text:'Disagree', value:2},  
      {text: 'Strongly Disagree', value:1}
```

```
    name: 'Discriminate',  
    stem: "Women often miss out on good jobs due to sexual discrimination",  
    answers: [  
      {text: 'Strongly Agree', value:5},  
      {text:'Agree', value:4},  
      {text:'Neutral', value:3},  
      {text:'Disagree', value:2},  
      {text: 'Strongly Disagree', value:1}
```

```
    name: 'SexismTV',  
    stem: "It is rare to see women treated in a sexist manner on television",  
    answers: [  
      {text: 'Strongly Agree', value:5},  
      {text:'Agree', value:4},  
      {text:'Neutral', value:3},  
      {text:'Disagree', value:2},  
      {text: 'Strongly Disagree', value:1}
```

name: 'SpouseEqual',

stem: "On average, people in our society treat husbands and wives (or male and female partners) equally",

answers: [

{text: 'Strongly Agree', value:5},

{text:'Agree', value:4},

{text:'Neutral', value:3},

{text:'Disagree', value:2},

{text: 'Strongly Disagree', value:1}

name: 'EqualOps',

stem: "Society has reached the point where women and men have equal opportunities for achievement",

answers: [

{text: 'Strongly Agree', value:5},

{text:'Agree', value:4},

{text:'Neutral', value:3},

{text:'Disagree', value:2},

{text: 'Strongly Disagree', value:1}

name: 'Concern',

stem: "It is easy to understand why women's groups are still concerned about societal limitations of women's opportunities",

answers: [

{text: 'Strongly Agree', value:5},

{text:'Agree', value:4},

{text:'Neutral', value:3},

{text:'Disagree', value:2},

{text: 'Strongly Disagree', value:1}

name: 'GovtMedia',

stem: "Over the past few years, the government and news media have been showing more concern about the treatment of women than is warranted by women's actual experiences",

answers: [

{text: 'Strongly Agree', value:5},

{text:'Agree', value:4},

{text:'Neutral', value:3},

{text:'Disagree', value:2},

{text: 'Strongly Disagree', value:1}

-----Section 4-----

name: 'Service',

stem: "What part of KPMG do you work in?",

answers: [

{text: 'CFO Advisory', value:1},

{text:'People, Performance & Culture', value:2},

{text:'Risk Management ', value:3},

{text:'Private Enterprise ', value:4},

{text: 'Markets & Growth ', value:5},

{text: 'Tax', value:6}

name: 'State',

stem: "What state do you mostly work in?",

answers: [

{text: 'Act', value:1},

{text:'NSW', value:2},

{text:'QLD', value:3},

{text:'SA', value:4},

{text: 'VIC', value:5},

{text: 'WA', value:6}

```

        name: 'JobTitle',
stem: "What is your role?",
    answers: [
        {text: 'Partner/Executive Director', value:1},
        {text:'Director', value:2},
        {text:'Associate Director/Senior Manager', value:3},
        {text:'Manager/Senior Executive', value:4},
        {text: 'Assistant Manager/Executive/Senior Accountant/Adviser/Senior
Consultant', value:5},
        {text: 'Executive/Analyst/Accountant/Consultant', value:6},
        {text: 'Undergraduate/Assistant Accountant', value:7},
        {text: 'Team member/Senior Team member', value:8}
    ],
    name: 'TimeOgr',
stem: "How long have you been at KPMG?",
    answers: [
        {text: 'Less than 1 year', value:1},
        {text:'1 year - less than 3 years', value:2},
        {text:'3 years - less than 5 years', value:3},
        {text:'5 years - less than 10 years', value:4},
        {text: '10 years - less than 15 years', value:5},
        {text: '15 years or more', value:6}
    ]

```

```
    name: 'Age',
  stem: "How old are you?",
  answers: [
    {text: 'Under 25 years', value:1},
    {text:'25 - 34 years', value:2},
    {text:'35 - 44 years', value:3},
    {text:'45 - 54 years', value:4},
    {text: '55 years and above', value:5}
```

```
    name: 'Ethnicity',
  stem: "What ethnicity are you?",
  answers: [
    {text: 'South Asian (Indian subcontinent)', value:1},
    {text:'East Asia (e.g., China, Japan, Korea, Thailand etc.)', value:2},
    {text:'Aboriginal and/or Torres Strait Islander', value:3},
    {text:'Black African/Black Caribbean/Black other', value:4},
    {text: 'Middle Eastern', value:5},
    {text: 'Pacific Islander', value:6},
    {text:'White/Caucasian/European', value:7},
    {text:'Hispanic/Latino', value:8},
    {text:'Mixed ethnic heritage', value:9},
    {text: 'Other', value:10}
```

```
    name: 'Gender',  
    stem: "What gender are you?",  
    answers: [  
      {text: 'Female', value:2},  
      {text:'Male', value:1}
```

## Appendix 2: Research information sheet and distribution email

### Research information sheet

**Project Title: The neuroscience of gender bias: implicit and explicit influences within organisations.**

#### Introduction

Jim Wicks (Bio attached), a partner in the firm Cultivating Leadership and a student at Victoria University, is undertaking a pilot study to better understand the relationship between groups in the organisation and the dynamics that emerge.

#### Aims & Objectives of the study

The central proposition underlying this research is that the gender composition of an individual's in-group has implications for their level of gender bias. This relationship is examined from the perspectives of both implicit and explicit bias. Implications for practice are considered through a complex adaptive systems (CAS) lens. The aims of this study are to:

- examine the relationship between in-group composition and gender bias using neuroscience and complex adaptive systems theory,
- test both implicit and explicit attitudes towards gender, and
- contribute to the theory and practice in relation to addressing gender bias

Contact details for Jim and his supervisor are:

Jim Wicks (researcher)

[James.Wicks@vuw.ac.nz](mailto:James.Wicks@vuw.ac.nz)

Dr Paul McDonald (supervisor)

[Paul.McDonald@vuw.ac.nz](mailto:Paul.McDonald@vuw.ac.nz)

#### Process and outputs

An electronic survey will be used to measure implicit and explicit bias. The survey will take approximately 20 minutes to complete.

The outputs from the research are planned to be a:

- masters thesis
- summary report and presentation for the firm
- summary/blog for the Cultivating Leadership website, and
- a draft journal article(s)

At a later date the information from this study may also be used in a doctoral thesis.



### **Anonymity and Confidentiality**

Anonymity of participants and confidentiality of information is important in a study of this nature to protect the identity of participants and promote free and frank responses. Information will not be attributed to individuals. All information gathered will be stored securely and only available in raw format to Jim Wicks and his research supervisor, Dr Paul McDonald. Information will be held only to meet academic requirements of this study and the possible future thesis.

### **Ethics and Consent**

This research has been approved by the Victoria University of Wellington Human Ethics Committee.

## Bio – Jim Wicks

Jim's core area of interest is Organisational Development and how to support organisations to be more adaptable. For Jim, this means refining organisational systems and processes as well as developing people capability to make workplaces successful and places where people can show up as their whole selves.

He has had an eclectic mix of career experiences through technical and senior leadership roles in the finance sector with Bank of New Zealand and AMP as well as stints in consulting and health. This mix has included technical trade finance and IT roles, and senior leadership roles in HR, Operations, Sales and Organisational Development as well as leading significant change projects.

His previous consulting experience was with a firm that specialised in supporting organisations to take a systemic approach to change following a systematic diagnostic approach. Within the firm Jim lead the capability practice as well as taking the lead on a number of client relationships.

Jim is a certified workplace coach, certified Prince 2 project manager, has completed advanced developmental coach training and the Global Leadership Profile certification. He has also developed ways to apply 'lean' concepts and organisational systems design and has been trained in organisation assessment against quality frameworks. These skills are complemented by a deep knowledge of adult development concepts and a compassionate approach when working with people.

Growing up in rural New Zealand he has retained an appreciation for the outdoors even though him and his family have lived in suburbia for over 25 years.

Jim joined [Cultivating Leadership](#) as a Partner in 2012. He is a trustee of the [Growth Edge Network](#) and has previously been a board member of the NZ Business Excellence Foundation.

## Distribution email

From:  
Subject: FW: Survey - Neuroscience of gender bias  
Date: 13 May 2015 at 4:17:35 PM NZST  
To: Jim Wicks

Hi Jim,

Please see below email that was sent. .... made some wording changes/additions.

The survey went out with a close date of next Friday but we will amend this in the reminder that goes out on Monday.

I hope this is ok.

Kind regards,

**From:**

**Sent:** Wednesday, 13 May 2015 9:35 AM

**Subject:** Survey - Neuroscience of gender bias



Dear valued team member,

At KPMG we know that diversity of thought and an inclusive culture drives innovation and business success. Under our firm strategy achieving diversity in our workforce is critical to our growth and long term sustainability.

In our [Diversity & Inclusion strategy](#), we are continuing to partner with leading organisations so we get the best research and thought leadership that is available around the world. We have recently engaged with James Wicks, who is working on some research on “the neuroscience of gender bias: implicit and explicit influences within organisations”.

As part of James’ research, we are approaching 400 people across the firm to participate in a survey so that James will be able to validate his hypothesis. The research study consists of three separate surveys. As you enter each section a brief explanation will be provided. Please be open with your answers and move as quickly as you can. Your anonymity will be protected throughout the process and all the information that you provide will remain confidential.

**Before starting the survey:** An important part of this research is to understand the makeup of your "in-group". Before starting the survey please quickly list on a bit of paper those people that you have an affinity with (up to 30 people). They will be the people that you gravitate towards. For

example often in professional life we come across challenges that stymie us, situations in which we seek the insights or opinions of others. The people we turn to in those situations are some of whom we are referring to as being part of our "in-group". We don't ask you to input names but you will need to answer questions in the survey on generic characteristics such as approximate age and occupation. Therefore having written down the list of your "in-group" is helpful.

Please allow approximately 20-25 mins to complete the survey: [Click here](#)

**Survey close date:** 5pm, Friday 22 May 2015

Your contribution into this important research is greatly appreciated. The results will add to the understanding of how the makeup of groups may impact the dynamics within an organisation. The findings will be reported back to KPMG with proposed recommendations and may also be used in James' doctoral thesis.



Thank you in advance for volunteering your time to partake in this survey and for your valuable input that will help us better understand group dynamics and unconscious bias.

Any questions regarding this survey can be directed to [.....](#). Alternatively, support can be obtained by contacting James Wicks at..... or via telephone +64 .....

Regards,

**National Managing Partner**  
**People, Performance & Culture**

### Appendix 3: Implicit association test<sup>10</sup>

The IAT measures the strength of associations between concepts (e.g. black people, gay people) and evaluations (e.g., good, bad) or stereotypes (e.g., athletic, clumsy). The main idea is that making a response is easier when closely related items share the same response key.

When doing an IAT you are asked to quickly sort words into that are on the left and right hand side of the computer screen by pressing the “e” key if the word belongs to the category on the left and the “i” key if the word belongs to the category on the right. The IAT has five main parts.

In the first part of the IAT you sort words relating to the concepts (e.g., fat people, thin people) into categories. So if the category “Fat People” was on the left, and a picture of a heavy person appeared on the screen, you would press the “e” key.

In the second part of the IAT you sort words relating to the evaluation (e.g., good, bad). So if the category “good” was on the left, and a pleasant word appeared on the screen, you would press the “e” key.

In the third part of the IAT the categories are combined and you are asked to sort both concept and evaluation words. So the categories on the left hand side would be Fat People/Good and the categories on the right hand side would be Thin People/Bad. It is important to note that the order in which the blocks are presented varies across participants, so some people will do the Fat People/Good, Thin People/Bad part first and other people will do the Fat People/Bad, Thin People/Good part first.

In the fourth part of the IAT the placement of the concepts switches. If the category “Fat People” was previously on the left, now it would be on the right. Importantly, the number of trials in this part of the IAT is increased in order to minimize the effects of practice.

In the final part of the IAT the categories are combined in a way that is opposite what they were before. If the category on the left was previously Fat People/Good, it would now be Fat People/Bad.

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<sup>10</sup> Downloaded from <https://implicit.harvard.edu/implicit/iatdetails.html>

The IAT score is based on how long it takes a person, on average, to sort the words in the third part of the IAT versus the fifth part of the IAT. We would say that one has an implicit preference for thin people relative to fat people if they are faster to categorize words when Thin People and Good share a response key and Fat People and Bad share a response key, relative to the reverse.

#### Appendix 4: Pilot study

A publically available (free-of-charge) version of the IAT has already been applied in a small pilot study in order to better understand the test and the nature of potential responses. The pilot study produced a number of issues.

Issue	Mitigation
Socially desirable responses – a number of respondents in the pilot study signalled in follow-up conversations that when they knew that they were responding to a test in relation to gender bias they likely responded in a way that they thought would minimise bias.	Minimise priming when inviting people to complete the test. Ask the implicit questions, questions about composition of in-group then explicit questions in that order to minimise priming.  Assure respondents of confidentiality and anonymity – processed by a third party.  Encourage respondents to answer explicit questions honestly.
In-group information collected outside of the survey was omitted by a number of respondents and required follow-up.	Ask Project Implicit to integrate the in-group composition questions to the IAT.
The public version of the test does not allow access to the underlying data.	Engage with Project Implicit, who will make underlying data available, including normative scores across studies.

Issue	Mitigation
Asking respondents to think about people in their in-group on the basis of inner circle and outer circle was useful as some people only had one or two people they considered held close.	Incorporate inner circle and outer circle categories for in-group into survey design.
Response rate was less than 50% after follow-up and despite those invited being primed and known to the researcher.	To ensure 150 responses it is proposed to distribute 500 tests.