

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

**BIOLOGICAL AND PSYCHOSOCIAL CORRELATES OF GENDER-
VARIANT
AND
GENDER-TYPICAL IDENTITIES**

**A thesis presented in fulfilment of the requirements for the degree of
Doctor of Philosophy
in
Psychology**

**at Massey University, Albany
New Zealand**

Jaimie F. Veale

2011

ABSTRACT

The aim of this thesis is to examine biological and psychosocial factors that contribute to the development of gender-variant or gender-typical identities. Blanchard's autogynephilia theory (Blanchard, 1989b) suggests that these factors are different in birth-assigned males with different sexual orientations. Previous research has found that genetics, prenatal hormone exposure, neuroanatomy, handedness, dermatoglyphics, fraternal birth order, and abuse are related to gender identity. While a number of investigators have studied these variables individually, this is the first known study to have examined the inter-relationships of these variables in one sample and to include participants with a wide range of gender identities. Data were collected from a convenience sample of 2,277 online-recruited participants with gender-variant and gender-typical identities using an online questionnaire. Participants were mainly white/Caucasian (92%) adults living in the USA (54%) and New Zealand (19%). From the results, reported family concordance for gender-variance and a systematic review of case reports of twins with gender-variant identities indicated genetic determinants of gender identities. Finger-length ratio, systemising, and a systematic review of case-reports of gender identity outcomes for adults with intersex and related conditions indicated prenatal hormone determinants of gender identities. Further evidence for biological factors came from elevated levels of non-right handedness among birth-assigned females with gender-variant identities. Structural equation modelling showed that the positive relationship between abuse experience and degree of adult gender-variance was partially mediated by recalled childhood gender-variance. This suggests abuse may be a cause as well as a result of gender-variance. Contrary to Blanchard's theory, there were no differences in biological and psychosocial factors between birth-assigned male participants of different sexual orientations. This was the first research to find evidence that biological and psychosocial factors are the same for transsexuals as for persons with other gender-variant identities. Overall, these findings add support for a biological predisposition for gender-variant and gender-typical identities. Psychosocial determinants are likely to be complex and work in interaction with biological factors.

ACKNOWLEDGEMENTS

I would like to express my appreciation for my supervisors, Dr Dave Clarke, Dr Terri Lomax, and Dr Steve Humphries for their support, guidance, and feedback during my PhD—especially with the ethics approval and examination process. I am grateful to Dr Richard Fletcher and Dr Suzanne Guerin for their consultations as part of the examination process.

I would like to thank Kirsty Furness, Matt Williams, and Bronwyn Castell for their valuable comments and proof-reading of this thesis. I would also like to thank Olivia Singh for her unwavering support during the Ph.D. thesis process. Finally, I would like to thank Tulia Thompson for valuable support with the examination process as well as providing useful comments and proof-reading.

TABLE OF CONTENTS

Abstract	ii
Acknowledgements	iii
Table of Contents	iv
List of Tables	ix
List Of Figures	xi
List Of Abbreviations.....	xii
SECTION I - Introduction	1
CHAPTER 1 - Introduction	2
1.1 Rationale	2
1.2 Terminology.....	3
1.3 Outline.....	3
SECTION II - Literature Review	5
CHAPTER 2 - Theories of Gender-Variant Identity Development.....	6
2.1 Early views of gender-variant identity development	6
2.2 Blanchard’s theory of autogynephilic and androphilic male-to-female transsexualism.....	8
2.2.1 Androphilic transsexualism.....	8
2.2.2 Autogynephilic transsexualism	10
2.2.3 Disagreement with Blanchard’s theory and associated perceptions of social desirability.....	12
2.2.4 Summary	13
2.3 Docter’s theory of gender-variant identity development.	13
2.4 Summary and implications for biological and psychosocial variables	14
CHAPTER 3 - Review of Research on Biological and Psychosocial Correlates	16
3.1 Biological factors	16
3.1.1 Genetics.....	16
3.1.1.1 Twins.....	16
3.1.1.2 Other within-family concordance	19
3.1.1.3 Genetic linkage studies	21
3.1.2 Prenatal hormones	22
3.1.2.1 Persons with intersex and related conditions	22
3.1.2.2 Direct measures of prenatal androgens	28
3.1.2.3 Indirect measures of prenatal androgens.....	28
3.1.3 Neuroanatomical differences	31

3.1.4 Handedness and dermatoglyphics	33
3.1.5 Familial variables	37
3.2 Psychosocial factors	38
3.2.1 Parental factors	38
3.2.2 Abuse	40
3.3 Summary and implications.....	42
3.3.1 Summary	42
3.3.2 Implications for theories of gender-variant identity development.....	42
CHAPTER 4 - Aims and hypotheses	44
4.1 Aim 1: To model biological and psychosocial variables predicting gender-variant and gender-typical identities	44
4.2 Aim 2: To examine the structure of latent variables associated with gender-variant and gender-typical identities	48
4.3 Aim 3: To examine the influence of social desirability response bias in the study of gender identity development.....	49
4.4 Summary	50
SECTION III - Methods.....	51
CHAPTER 5 - Methods	52
5.1 Design	52
5.2 Participants.....	52
5.3 Questionnaire	55
5.3.1 Demographics	56
5.3.2 Family history	56
5.3.3 Hand variables.....	57
5.3.4 Sexual orientation.....	58
5.3.5 Social desirability.....	58
5.3.6 Abuse	59
5.3.7 Spatial ability	60
5.3.8 Systemising	60
5.3.9 Degree of gender-variance	61
5.4 Sampling issues.....	62
5.5 Procedure.....	63
5.5.1 Preparation of data	63
5.6 Data analysis	64
5.6.1 Overview of structural equation modelling.....	64
5.6.2 Reliability analysis	66

5.6.3 Model fit indices	67
5.6.3.1 χ^2 likelihood ratio test.....	67
5.6.3.2 Comparative fit index (CFI) and Tucker-Lewis index (TLI).....	68
5.6.3.3 Root mean square error of approximation (RMSEA).....	68
5.6.3.4 Standardised root mean square residual (SRMR).....	68
5.6.3.5 Expected cross-validation index (ECVI)	69
5.6.4 Data analysis procedure	69
5.6.4.1 Confirmatory factor analysis.....	69
5.6.4.2 Measurement invariance testing.....	69
5.6.4.3 Hypothesis testing	71
SECTION IV - Results.....	72
CHAPTER 6 - Testing and Modification of Measures.....	73
6.1 Edinburgh handedness scale	73
6.2 Emotional abuse.....	75
6.3 Mental rotation.....	77
6.4 Systemising	79
6.5 Adult gender-variant identity	82
6.6 Recalled childhood gender-variance	84
6.7 Balanced inventory of desirable responding.....	85
6.8 Summary of confirmatory factor analyses	88
6.9 Descriptive statistics for observed variables	89
CHAPTER 7 - Results of Hypotheses	90
7.1 Between-group differences	90
7.2 Biological and psychosocial variables predicting adult gender-variance	100
7.3 Moderation of sexual orientation	104
7.4 Within-family concordance of transsexualism	106
SECTION V - Discussion	107
CHAPTER 8 - Discussion.....	108
8.1 Biological and psychosocial correlates	108
8.1.1 Number and ratio of siblings.....	109
8.1.2 Number of aunts and uncles.....	110
8.1.3 Within-family concordance of sexuality- and gender-variant relatives.....	110
8.1.4 Handedness	111
8.1.5 Abuse	112
8.1.6 Finger length ratio.....	112

8.1.7 Mental rotation	113
8.1.8 Systemising quotient	114
8.1.9 Parental age	116
8.1.10 Parental cohabitation	116
8.1.11 Socially desirable responding	117
8.1.12 Sexual orientation as a moderating variable among birth-assigned males	118
8.1.13 Findings of participants with other gender-variant identities relative to transsexual and gender-typical participants	119
8.1.14 Conclusions	119
8.2 Social context of gender-variant identities	120
CHAPTER 9 - Limitations, Implications, and Conclusions	122
9.1 Reliability and validity of the measures	122
9.2 Limitations	123
9.3 Theoretical implications	125
9.4 Wider implications	126
9.5 Suggestions for future research	127
9.6 Conclusions	129
SECTION VI - References	132
Reference List:	133
SECTION VII - Appendices	158
APPENDIX A - Call for Participants on Online Forums	159
APPENDIX B - Questionnaire	160
B.1 Information sheet	160
B.2 Demographics	161
B.3 Family information	162
B.4 Hand variables	163
B.5 Sexuality variables	164
B.6 Recalled childhood personality	165
B.7 Balanced Inventory of Desirable Responding	166
B.8 Abuse	167
B.9 Coping and defence styles	167
B.10 Spatial ability	169
B.11 Systemising Quotient	174
B.12 Gender-variance degree	175
B.13 Gender-variance experience	176

B.14 Appraisal of the identity-defence theory	179
B.15 Order of randomly presented questions.....	183
APPENDIX C - Use of “Online Ruler” to Self-Measure 2D:4D	186
C.1 Method.....	186
C.2 Results	187
C.3 Discussion	188
APPENDIX D - Additional Statistics for Confirmatory Factor Analyses.....	190
APPENDIX E - Correlation Matrices and Regression Coefficients for Structural equation models	193
APPENDIX F - Calculation of Proportion of Measurement Error Variance for Digit Ratio (2D:4D)	197

LIST OF TABLES

Table 3.1 <i>Reports of twins at least one case of transsexualism in the academic literature</i>	17
Table 3.2 <i>Summary of studies of within-family concordance of gender-variance</i>	21
Table 3.3 <i>Reference, clinical diagnosis, and assigned gender details for cases used in the analysis</i>	24
Table 3.4 <i>Frequency and percentage of clinical diagnosis and gender-variant identity outcomes for cases used in this study</i>	26
Table 3.5 <i>Summary of studies of 2D:4D among persons with gender-variant identities</i>	29
Table 3.6 <i>Summary of studies of PCOS among FM transsexuals</i>	30
Table 3.7 <i>Summary of studies of cognitive tests among gender-variant persons</i>	34
Table 3.8 <i>Summary of studies of handedness among gender-variant persons</i>	35
Table 3.9 <i>Summary of studies of abuse among gender-variant persons</i>	41
Table 5.1 <i>Mahalanobis distance for the ten cases farthest from the centroid.</i>	53
Table 5.2 <i>Gender identity, education, ethnicity, country, and age of participants grouped by birth-assigned gender</i>	54
Table 6.1 <i>Models and fit statistics for the Edinburgh handedness inventory estimated with robust maximum likelihood</i>	73
Table 6.2 <i>Robust maximum likelihood estimates for the 6-item Edinburgh handedness inventory</i>	74
Table 6.3 <i>Invariance testing fit statistics for the Edinburgh handedness inventory</i>	75
Table 6.4 <i>Models and fit statistics for the emotional abuse scale estimated with robust maximum likelihood</i>	76
Table 6.5 <i>Robust maximum likelihood estimates for the four-item emotional abuse scale</i>	76
Table 6.6 <i>Invariance testing fit statistics for the emotional abuse scale</i>	77
Table 6.7 <i>Robust maximum likelihood estimates for the mental rotation test</i>	78
Table 6.8 <i>Birth-assigned gender invariance testing models and fit statistics for the mental rotation test</i>	79
Table 6.9 <i>Models and fit statistics for the systemising quotient estimated with robust maximum likelihood</i>	80

Table 6.10 <i>Robust maximum likelihood estimates for the four-factor systemising quotient</i>	81
Table 6.11 <i>Invariance testing fit statistics for the systemising quotient</i>	82
Table 6.12 <i>Models and fit statistics for adult gender-variant identity estimated with robust maximum likelihood</i>	83
Table 6.13 <i>Robust maximum likelihood estimates for the adult gender-variant identity scale</i>	83
Table 6.14 <i>Invariance testing fit statistics for the adult gender-variant identity scale</i> ..	84
Table 6.15 <i>Robust maximum likelihood estimates for the three factor recalled childhood gender-variance scale</i>	85
Table 6.16 <i>Invariance testing fit statistics for the recalled childhood gender-variance scale</i>	86
Table 6.17 <i>Models and fit statistics for recalled childhood gender-variance estimated with robust maximum likelihood</i>	86
Table 6.18 <i>Robust maximum likelihood estimates for the three factor, 12 item BIDR</i> ...	87
Table 6.19 <i>Invariance testing fit statistics for the BIDR</i>	88
Table 6.20 <i>Descriptive statistics for non-latent measures used in this thesis</i>	89
Table 7.1 <i>Logistic regression of biological and psychosocial variables with level of gender-variant identity and birth-assigned gender as independent variables</i>	91
Table 7.2 <i>Paired samples t-test for difference between number of brothers and number of sisters</i>	99
Table 7.3 <i>Paired samples t-test for difference between number of maternal aunts and number of maternal uncles</i>	99
Table 7.4 <i>Scaled difference χ^2 from freeing between-gender parameter constraints</i> ...	100
Table 7.5 <i>Scaled difference χ^2 from freeing parameter constraints for variables predicting adult gender-variance in samples excluding homosexual and non-homosexual birth-assigned males</i>	105
Table 7.6 <i>Unstandardised regression coefficients for biological and psychosocial predictors of adult gender-variance in birth-assigned male androphilic and non-androphilic groups</i>	106
Table 9.1 <i>Summary of contributions of the research</i>	131

LIST OF FIGURES

Figure 4.1 <i>Illustration of Hypothesis 1—biological and psychosocial variables predicting adult gender identity</i>	46
Figure 4.2 <i>Modelling to test Hypothesis 2—sexual orientation influencing the relationship between biological/psychosocial factors and adult gender identity in birth-assigned males</i>	47
Figure 4.3 <i>Proposed modeling to incorporate the relationship between childhood gender expression, abuse, and adult gender identity</i>	48
Figure 4.4 <i>Illustration of inclusion of measurement models into model of biological and psychosocial factors predicting gender identity</i>	49
Figure 4.5 <i>Illustration of aim to incorporate social desirability as a covariate into the model</i>	50
Figure 7.1 <i>Gender identity group means and 99% confidence intervals for number of older brothers.</i>	92
Figure 7.2 <i>Gender identity group means and 99% confidence intervals for proportion of relatives with gender-variant identities.</i>	93
Figure 7.3 <i>Gender identity group latent means and 99% confidence intervals for emotional abuse, with MF transsexuals as comparison group.</i>	94
Figure 7.4 <i>Gender identity group means and 99% confidence intervals for sexual abuse.</i>	95
Figure 7.5 <i>Gender identity group latent means and 99% confidence intervals for handedness, with transsexuals as comparison group</i>	95
Figure 7.6 <i>Gender identity group latent means and 99% confidence intervals for mental rotation, with MF transsexuals as comparison group.</i>	96
Figure 7.7 <i>Gender identity group latent means and 99% confidence intervals for systemising quotient, with MF transsexuals as comparison group.</i>	97
Figure 7.8 <i>Gender identity group means and 99% confidence intervals for mother's age.</i>	97
Figure 7.9 <i>Gender identity group means and 99% confidence intervals for paternal cohabitation.</i>	98
Figure 7.10 <i>Structural equation model for biological and psychosocial variables predicting adult gender-variant identity showing standardised coefficients.</i>	102
Figure 7.11 <i>Structural equation model for biological and psychosocial variables (excluding systemising quotient) predicting adult gender-variant identity showing standardised coefficients.</i>	103

LIST OF ABBREVIATIONS

17 β -HSD	17 β hydroxysteriod dehydrogenase
5 α -RD	5 α reductase deficiency
2D:4D	ratio between the length of the second and fourth fingers
BIDR	balanced inventory of desirable responding
BSTc	central subdivision of the bed nucleus of the stria terminalis
CAH	congenital adrenal hyperplasia
CI	confidence intervals
DZ	dizygotic
FM	female-to-male
INAH-3	interstitial nucleus of the anterior hypothalamus nuclei 3
MF	male-to-female
MGD	mixed gonadal dysgenesis
MZ	monozygotic
OGV	other gender-variant identity
PAIS	partial androgen insensitivity syndrome
PCOS	polycystic ovary syndrome
SE	standard error
SEM	structural equation modelling