

Faculty of Engineering and Information Technology
University of Technology, Sydney

**Understanding Distortion and Biases
in Individual Information Processing
under Social Impact**

A thesis submitted in partial fulfillment of
the requirements for the degree of
Doctor of Philosophy

by

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July 2016

CERTIFICATE OF AUTHORSHIP/ORIGINALITY

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

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Contents

Certificate	i
Acknowledgment	iii
List of Figures	ix
List of Tables	xi
List of Publications	xiii
Abstract	xv
Chapter 1 Introduction	1
1.1 Background	1
1.2 Research Issues	4
1.2.1 Intra-Psychological Mechanisms of Distortion and Bi- ases in Individual Information Processing	5
1.2.2 Contextual Effects of Social Impact on Distortion and Biases in Individual Information Processing	8
1.2.3 Testing and Refining the Theoretical Models: Labora- tory Experiments and Simulations	12
1.2.4 Applications of Theories and Methodologies in Actual Decision-Making Context	15
1.3 Research Contributions	16
1.4 Thesis Structure	18
Chapter 2 Literature Review and Theoretical Foundations	22
2.1 Information Cognitive Processing and Attitude Development	23
2.1.1 Processes and Affecting Factors	24

CONTENTS

2.1.2	Perspective of Motivation	30
2.1.3	Discrepancy Processing and Counterarguing	32
2.1.4	Metacognition	33
2.1.5	Cognitive Processing in Sequential Exposure Contexts	34
2.2	Information Distortion, Cognitive Biases and Heuristic Processing	35
2.2.1	Bounded Rationality	35
2.2.2	Heuristics	37
2.2.3	Cognitive Biases	39
2.2.4	Information Distortion	40
2.2.5	Summary	41
2.3	Social Impact	42
2.3.1	Perspectives in Social Psychology for Understanding Social Impact	43
2.3.2	The Effects of Social Impact	47
2.3.3	Dynamics and Evolution of Social Impact at the System Level	51
2.3.4	The Role of Social Structure	54
2.4	Summary	56
Chapter 3 Attitudes, Distortion and Biases: Conceptualisation and Measures		58
3.1	Attitude	58
3.1.1	Message Attitude	59
3.1.2	Individual Attitude	59
3.1.3	Attitude Measure	60
3.2	Perceived Message Attitude Deviation	64
3.3	Cognitive Dissonance	65
3.4	Information Distortion and Cognitive Biases	67
3.4.1	A Rethinking	67
3.4.2	Information Distortion Measure	73
3.4.3	Cognitive Bias Measure	75

3.5	Summary	75
 Chapter 4 Distortion and Biases in Individual Information		
Processing: An Empirical Study		77
4.1	Research Model and Hypotheses	78
4.1.1	Interactions among Attitudes, Distortion and Biases	80
4.1.2	Elaboration and Sense Making	81
4.1.3	Perceived Argument Quality	83
4.1.4	Perceived Argument Adequacy	83
4.1.5	Perceived Source Credibility	84
4.2	Research Methods	85
4.2.1	Stimuli Design	88
4.2.2	Instrumentation	90
4.2.3	Procedure	97
4.2.4	Data Collection	99
4.3	Data Analysis	99
4.3.1	Descriptive Statistics	100
4.3.2	Reliability and Validity of Instruments	102
4.3.3	Structural Model Testing	103
4.4	Discussion	103
4.4.1	Interactions between Elaboration for Sense-Making and Distortion for Consistency	108
4.4.2	Effects of Cognitive Dissonance	109
4.4.3	Effects of Sequential Exposure	110
4.4.4	Contributions and Limitations	113
4.5	Summary	114
 Chapter 5 Distortion and Biases in Individual Information		
Processing Under Social Impact: Social Computing		116
5.1	Research Design	117
5.1.1	Model at Individual Level	118
5.1.2	Model at Societal Level	125

CONTENTS

5.1.3	Bridging the Dual-Observation Models	127
5.1.4	Other Accounts	130
5.2	Implementation of Social Computing	131
5.2.1	Objectives of Social Computing	131
5.2.2	Structure of the Social Simulator	132
5.2.3	Interfaces of the Social Simulator	132
5.2.4	Initialising Social Computing	137
5.3	Results and Discussions	139
5.3.1	Cognitive Effects Under versus Not Under Social Impact	139
5.3.2	Effects of Overall Societal Cognition States	139
5.3.3	Social Effects Involving versus Not Involving Distorted Information Processing	145
5.3.4	Effects of Social Contact Degree	148
5.3.5	Effects of Social Structure Dynamics	148
5.3.6	Effects of Population Heterogeneity	153
5.3.7	Impact of External Influence Sources	155
5.4	Summary	157
Chapter 6 Conclusions and Future Work		158
6.1	Conclusions	158
6.2	Implications	161
6.3	Future Work	163
Bibliography		165

List of Figures

1.1	Profile of Work in This Thesis	21
3.1	The Scaling and Labelling of Attitude	64
3.2	The Developed Attitude and the Corresponding Distortion Status ($ disson_t \geq 2$)	74
3.3	The Developed Attitude and the Corresponding Distortion Status ($ disson_t < 2$)	74
4.1	Organisation of Chapter 4	78
4.2	Conceptual Model for Understanding Distortion and Biases in Individual Information Processing	80
4.3	Procedure of Empirical Study	98
4.4	Path Analysis Results of the Structural Equation Model . . .	106
4.5	The Effects of Cognitive Dissonance on Attitude Shaping, Dis- tortion and Biases	111
4.6	The Effects of Perceived Message Attitude Deviation on Atti- tude Shaping, Distortion and Biases	112
4.7	Changes in Distortion and Biases after Sequential Exposure .	114
5.1	A Synthesised Model Accounting for Distortion and Biases in Individual Information Processing	118
5.2	The Relationship between Information Distortion and Cogni- tive Dissonance	124

LIST OF FIGURES

5.3 The Basic Processing Model of Social Impact between Dual Agents 129

5.4 Social Impact in the Context of Sequential Exposure to Social Information and Media Messages 129

5.5 Sequence Diagram of the Social Simulator 133

5.6 The Main Form of the Social Simulator 134

5.7 The Editing Form for External Influencing Sources 134

5.8 The Displayer for Social Computing Outcomes 135

5.9 The Displayer for Social Computing Outcomes (Cont.) 136

5.10 Attitude Effects Under versus Not Under Social Impact 140

5.11 Attitude Effects of Different Overall Societal Orientations . . . 142

5.12 Distribution of Initial Societal Attitudes When the Overall Orientation is Extreme 143

5.13 Attitude Effects of Different Public concerns 143

5.14 Attitude Effects of Different Societal Knowledge Levels 144

5.15 Social Effects Involving versus Not Involving Distorted Information Processing 146

5.16 The Effects of Cues Tempering Factor on Information Distortion 147

5.17 The Effects of Reinforcement Factor on Information Distortion 149

5.18 The Effects of Boomerang Factor on Information Distortion . 150

5.19 The Effects of Social Contact Degree 151

5.20 The Effects of Social Structure Dynamics 152

5.21 The Effects of Heterogeneity on Social Cognition Distribution 153

5.22 The Effects of Population Heterogeneity 154

5.23 The Impact of External Influencing Campaigns 156

List of Tables

2.1	The Framework of Literature Review	23
3.1	Attitude Adjustments as per Reported Attitude and Confidence	61
3.2	Symbols Associated with Attitude-Relevant Measures	63
3.3	Rubrics of Information Distortion	71
4.1	Conceptual Model and Measurement Model	86
4.2	Conceptual Model and Measurement Model (Cont.)	87
4.3	Descriptive Statistics	101
4.4	Reliability and Convergent Validity	104
4.5	Discriminant Validity	105
4.6	Indices of Model Fit	106
4.7	Results of Structural Model Testing	107
4.8	Measure Changes after Sequential Exposure	113
5.1	Mappings between a Regular Message and an Interactive Mes- sage	128
5.2	Symbols (Abbreviations) for Social Computing Parameters . .	141

List of Publications

Books Published

- **Yonghua Cen**, Ping Zhang, Yingnan Xu, Hong Zhang (2015). Research on Technology Acceptance of E-Commerce Recommendations: Perspectives of Consumer Cognition. Science Press, Beijing, China. (ISBN: 978-7-03-046205-3)
- Yanchang Zhao, **Yonghua Cen** (Eds.)(2013). Data Mining Applications with R. Elsevier Academic Press. (ISBN: 978-0-12-411511-8)

Papers Published

- **Yonghua Cen***, Liren Gan, Chen Bai (2013). Reinforcement Learning in Information Searching. *Information Research: An International Electronic Journal*, 18(1), paper.569.
- **Yonghua Cen***, Xiaoshu Wang, Qing Wan, Linling Tao (2016). An Empirical Study on the Mechanisms of Individual Cognitive Processing and Attitude Development, *Chinese Journal of Management*, 13(6), pp.880-888.
- **Yonghua Cen***, Linling Tao, Dandan Ma, Xiaoshu Wang (2016). A Review of Behavior Diffusion in Social Networks: Theories and a Dual-Observation Framework, *Information Studies: Theory and Application (China)*, 39(8), pp.133-138, To be Appeared.

Papers to be Submitted/Under Review

- **Yonghua Cen***, Can Zhang, Chengyao Wu (2016). Individual Attitude Development Under Social Impacts: Evidence from Internet Group Discussion. *Management Review (China)*, Under review.
- Xia Tu*, **Yonghua Cen*** (2015). An Empirical Study on the Intention of Using Catering Take-out APPs under O2O Catering Contexts, *Management Review (China)*, Under review.
- **Yonghua Cen***, Chengyao Wu (2015). A Dual-Observation Framework for Understanding Distortion and Biases in Individual Information Processing under Social Impacts. *To be submitted*.
- **Yonghua Cen***, Dandan Ma, Can Zhang, Chengyao Wu, Xiaoshu Wang (2015). Biases in Individual Decision-making: A Empirical Study from the Perspectives of Information Sampling. *To be submitted*.
- Bingling Wu, **Yonghua Cen***, Chengyao Wu (2015). Phenomena Interpretation of Individual Overconfidence: Perspectives of Channel Theory. *To be submitted*.

Research Reports of Industry Projects

- **Yonghua Cen**, Chao Luo, Huaifeng Zhang, Yanchang Zhao. Comparative Analysis of Income Declaration Model and NSA SVU model (Final Report of the First Sub-project of the 2010 ARC Linkage Project - Detecting Significant Changes in Organisation Customer Interactions Leading to Non-compliance (LP100200774)). Centrelink. Jun 2011.
- **Yonghua Cen**, Huaifeng Zhang. Architecture Proposal for Centrelink Online Alert System. Centrelink. Sept 2011.

Abstract

Individual information processing and attitude development are fundamental aspects in a variety of decision-making scenarios. They are also important topics concerned in decision sciences, behavioural economics, psychology, and social sciences in recent years. Human information processing is always carried out in specific social contexts, where the implicit, imaginary or real presences of other individuals or organisations have potential impact on human attitude formation and decision-making. Along with the rapid innovations in interaction channels and interplaying patterns of social interactions, especially those facilitated by the ongoing growth of Internet technologies, the study of individual behaviour mechanisms with social impact has become the frontier and focus of a variety of relevant disciplines.

In existing research regarding information processing, information distortion, cognitive biases and heuristics, the influence of other individuals or groups and the complex and dynamic evolution of such influence in a longer spatial and temporal context with different population compositions are often overlooked. At the same time, the majority of previous studies investigating social impact at the collective scale of society laid major emphases on the dynamics of social networks, which define stylish individual rules but lack robust empirical validation. Therefore, to understand the distortion and biases in individual information processing under social impact, especially in specific application scenarios, a more reliable way is to delicately integrate the individual information processing at the bottom level with the social impact and system dynamics at the top level. This reflects the very starting-point

of the present research and a major aspect towards breakthrough research.

The major work in this thesis proceeds from the conceptualisation of several critical attitude-relevant constructs and the design of their measurements in the light of literature. These constructs surround attitude, cognitive dissonance, information distortion and cognitive bias, which are mathematically pictured. The conceptualisation and measurement development of these constructs build a scaffolding for further empirical analysis at the individual level and social computing at the societal level. At the same time, the measurement design affords a substantial solution in response to the notable lack of research attempts quantitatively capturing the complicated intra-psychological mechanisms underpinning individual information processing and the consequential distortion and biases.

Building on this conceptualisation and measurement design, as well as a comprehensive review of massive cross-discipline literature, this research further elaborates a conceptual model to explain the procedures and causal mechanisms of individual information processing and attitude development, and penetrates into the precursors of distortion and biases at the individual level. The model includes perceived argument quality and adequacy, source credibility and individual prior attitude as exogenous latent constructs (causal variables), and incorporates elaboration/sense-making, perceived message attitude, individual posterior attitude, distortion and bias, as endogenous latent constructs (effect variables). Particularly, the study accentuates the effects of cognitive inconsistency between the prior attitude of an individual and the attitude advocated by the message (i.e., cognitive dissonance) on posterior attitude, distortion and bias. The conceptual model was tested by following a typical empirical approach from stimuli manipulation, instrumentation, experiment design, data collection, to data analysis and findings discussions.

This empirical study at the individual level leads to the findings as follows: (1) perceived message quality and perceived source credibility have positive impacts on an individual's elaborating and making sense of an incoming per-

suasive stimulus, which contributes to the individual's attitude shift towards the stimulus advocacy; (2) the state of cognitive dissonance drives an individual to distortedly and biasedly process the inconsistent cognitive elements implied in an persuasive stimulus, which then restrains the individual from moving towards the stimulus advocacy; (3) individuals' elaboration of an incoming stimulus for sense-making and their information distortion for consistency are two paralleling and competing forces for attitude construction, which reflects the complicated nature of human information processing behaviour; (4) cognitive dissonance plays a critical role in the two competing forces; (5) sequential exposure to advocacy-consistent stimuli may gradually alleviate an individual's information distortion and cognitive biases.

As the most important aspect of the existing research, social computing is introduced to describe the information distortion and cognitive biases at a societal level. In the light of knowledge acquired from the empirical study at the individual level, an integrative model conceptualising the causal and procedural relationships involved in individual information processing is elaborated, which is bridged with a social contagion model. These dual theoretical models are further translated into computational models, where the variables concerning society, agent population, messaging and external persuasion campaign, as well as the transitional functions reflecting the relationships between the variables, are mathematically defined. Drawing upon the social computational results, the complexity of information distortion and cognitive biases situated in social impact is unravelled.

Major findings in the social computing work at the societal level are below. (1) Without interactions with others, people keep silence and isolated, maintaining stable attitudes. When people interplay with others, their attitude may alter. (2) When the whole society manifests a skew towards an extreme, the substantial majority stands together with high agreement, and their attitudes soon polarise. Those limited dissenters who feel isolated and severe conflicts with the majority will champion their positions in a strongly distorted way. Furthermore, when a non-polarised majority dominates the

ABSTRACT

minority, the former convert the latter while consolidating their own places. When they are mixed with two matching opposite forces in a society, the effect of neutralisation or negotiation governs the evolution of attitudes, the overall value of the society may converge to a point. (3) The null hypothesis asserted by most social psychologists only holds true in the condition where individuals will not distort the social information presented to them. However, in reality where people often distortedly or biasedly process the issue-relevant information, it is a long way (or even no way) to reach the uniformity and convergence, and there are substantial distortion and biases especially for the minority party. (4) A highly interconnected and fluid society entails active and frequent exchanges among the reshuffling members, leading to intensive changes in social states. The more interconnected a society is, the less distortion and biases happen; and when social cognition converges, the distortion and biases therefore disappear, due to the reached agreement. (5) A homogeneous society is more likely to reach a uniformity and convergence, whereas a heterogeneous society is more likely to end up with chaos, antagonism, and polarisation. These findings deserve intensive attention. (6) Individuals are often exposed to external influence information sources, such as massive media, lectures, promotions, and other kinds of persuasive campaigns, while exchanging with surrounding people. These campaigns interplay with communicative social information, and facilitate or suppress their cognition.

This research entertains the frontier concerns in the associated fields. It is expected to provide meaningful insight for further theoretical and methodological research as well as applications of individual information processing and attitude formation.