Faculty of Engineering and Information Technology
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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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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.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

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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)

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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

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.