# UNIVERSITI TEKNOLOGI MARA

# EFFECTS OF INFORMATION VISUALIZATION TECHNIQUES AND DECISION STYLE IN DECISION SUPPORT ENVIRONMENT: AN EXPERIMENTAL APPROACH

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Thesis submitted in fulfillment of the requirements
for the degree of
**Doctor of Philosophy**

**Faculty of Information Technology and Quantitative Sciences**

**August 2007**

# Candidate's Declaration

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This topic has not been submitted to any other academic institution or non academic institution for any other degree or qualification.

In the event that my thesis be found to violate the condition mention above, I voluntarily waive the right of conferment of my degree and agree be subjected to the disciplinary rules and regulations of Universiti Teknologi MARA.

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Thesis Title    :    **Effects of Information Visualization Techniques and Decision Style in Decision Support Environment: An Experimental Approach**

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# ABSTRACT

Information visualization (IV) is an emerging technology that relies on the human's perception and cognitive abilities to visualize. Incorporating IV techniques to the decision support system (DSS) is the potential solution to improve system's effectiveness and to provide decision-makers with powerful decision support environment. The aims of IV are to support a deeper understanding and to foster new insights to decision-makers about the data that they are analyzing. Many innovative IV techniques have been developed. However, empirical evaluation on IV techniques is still at its early stage and still lacking in numbers, particularly in the area of business decision support applications. Besides, the adoption of IV techniques as reported in the literature, is still minimal. More evidence of measurable benefits supporting the use of IV is needed, and more attention to individuals' cognitive differences is recommended, to realize its potential advantage. In the human computer interaction (HCI) and IV literature, the importance of individual differences has been emphasized. However, decision style, which is recognized as one of the key individual cognitive differences that affects system success, has received little attention in these areas. Meanwhile, in the DSS literature, decision style has been acknowledged to affect decision-making performance and one's preferences for human-machine-interface. Unfortunately, it has frequently been overlooked and rarely been given priority in the DSS design. This study aims to bridge these gaps. This thesis examines the extent to which individual differences with decision style in particular, IV techniques and task types affects decision performance, workload rating, and user satisfaction in the managerial decision support environment. The thesis adopts an experimental method, based on within-participant design approach. The results of this study show that there are significant differences in decision performance between IV techniques, individual differences and task. The *overview+detail(O+D)* techniques outperform *zoom+pan(Z+P)* technique in completion time, and workload rating. Besides, the study demonstrates that there is a significant difference in user preferences for IV techniques, with majority prefers *O+D* techniques compared to *Z+P*. This indicates that user preferences of IV technique is affected by time and effort required to complete a task. In addition, the results suggest that decision style is a significant moderator on the relationship between IV and performance. Findings from the work of this thesis provide theoretical, empirical and practical contributions. This thesis provides theoretical contribution in terms of introducing a new dimension, decision style, and presenting the IV/DSS framework. Besides, the proposal of the *Expressive IV Taxonomy* is a novelty contribution of this thesis. This taxonomy aims to facilitate the design and evaluation of IV techniques in decision support environment. This thesis explores and reports the potential of main and interaction effects of decision style on decision performance and workload rating in using different IV techniques. The results provide empirical contributions, which support the importance of matching the interface technology with individuals' task requirements and individuals' cognitive and perceptual needs. In terms of practical contributions, the findings have important implications for the DSS designers, and provide important research issues for future work.

# ACKNOWLEDGEMENTS

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