

**MODELLING DYNAMICS OF VICTIMS' STRESS  
DURING NATURAL DISASTER**

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## **Abstrak**

Bencana alam merupakan fenomena alam yang menyumbang kepada pembentukan masalah psikologi kepada kebanyakan individu. Tekanan psikologi adalah salah satu kesan akibat daripada bencana ini dan ianya merupakan realiti sebenar dimana kesan daripada persekitaran luar yang menyebabkan individu mengalami tekanan yang akan lambat laun boleh membawa kepada masalah psikologi. Dalam bidang pengkomputan psikologi, pemodelan komputasi telah digunakan sebagai alat untuk memahami corak fungsi kognitif dan tingkahlaku manusia. Manakala, teori-teori psikologi dan kognitif serta bukti empirikal adalah berguna dalam menyediakan asas yang kukuh mengenai faktor serta atribut yang menyebabkan tekanan psikologi untuk mangsa banjir sewaktu bencana alam itu berlaku. Oleh itu, kajian ini telah menggunakan model formal (model komputasi) dalam memahami keadaan semasa tekanan perasaan mangsa bencana alam. Dengan menggunakan teori yang berkaitan, terdapat 22 faktor asas telah dapat dikenalpasti dan dikelaskan kepada 7 kategori utama termasuk faktor kecenderungan, sumber, atribut individu, penilaian, kebingkasan, keupayaan bertahan, dan tekanan. Faktor ini telah dapat memberikan pengetahuan asas terhadap tingkahlaku mangsa sewaktu bencana alam berlaku. Satu model formal telah dibangunkan dengan menggunakan kaedah persamaan pembezaan. Selepas itu, model ini telah disimulasikan berdasarkan senario yang berkaitan seperti; 1) mangsa dengan tahap tekanan yang rendah, 2) mangsa dengan tahap tekanan yang sederhana, dan 3) mangsa dengan tahap tekanan yang tinggi dengan menggunakan bahasa pengaturcaraan Matlab. Model komputasi ini telah disahkan dengan menggunakan dua teknik; 1) penentusahan logikal (*Temporal Trace Language*) dan 2) penentusahan matematik (analisis kestabilan). Hasil eksperimen telah berjaya menerangkan secara anggaran mengapa mangsa mengalami masalah tekanan dalam keadaan yang berbeza sewaktu bencana alam berlaku.

## **Abstract**

Natural disaster is one of the inescapable phenomenon through which numerous number of individuals are being affected via developing psychological problems. Stress is one of the essential psychological effects of natural disaster; it is a reality of nature where forces from the outside world affect individuals exposed to such phenomenon. In computational psychology domains, computational models were used as tools for understanding human cognitive functions and behavioural patterns. Meanwhile, psychological and cognitive theories as well as empirical studies have provided convergent evidence to identify important factors and psychological attributes that affect the stress level of victims during natural disaster. Therefore, this study implements a formal model (computational model) to understand the current state of victims' stress during natural disaster. From related theories, 22 of basic factors have been established and grouped into 7 main categories that include predisposed factors, resources, individual attributes, appraisal, resilience, coping, and stress. Those factors provide the fundamental knowledge of the behaviours of victims after disaster occurrence. A formal model was developed by using a set of differential equations. Later, this model was simulated by applying related scenarios based on three different cases, namely; 1) a good victim with low level of stress, 2) victim with high level of stress, and 3) victim with moderate level of stress) through the use of Matlab as a programming language. This computational model was then verified using two techniques; 1) logical verification (Temporal Trace Language) and 2) mathematical verification (stability analysis). The experimental results have approximately predicted why victims develop stress differently when facing natural disasters.

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# CHAPTER ONE

## INTRODUCTION

This chapter briefly explains the background of the study, problem statement, research questions, objectives, significance and scope of the study.

### 1.1 Background

Each society and its parts (e.g., individuals, groups, organizations, communities, etc.) are frequently and occasionally in an unexpected manner to exposed to disasters, whether a disaster happened through technological failure or industrial mistakes (such as explosion, widespread power outages, and structure collapse) or as a natural phenomenon (e.g., flood , earthquakes ,and landslides), or by virtue of human-making (e.g., terrorism and riots), or hybrid disasters (e.g., the setting of residential zones, factories, at the foot of an active volcano, or in an avalanche area). The normal settings of a society and its components will be affected in a more or less serious manner. Disasters are specific form of stressor in that they impact wide areas of population at once and may be accompanied by a large number of possible harmful outcomes such as mass casualties, displacement, and property damage (Norris, 2002). In addition, survivors may be exposed to secondary hazards, for instance, in the case of hurricane Katrina, the damage of the oil facilities by the hurricane caused the hazardous materials to be exposed into the environment. A disaster whether through natural events such as hurricane Katrina or human-making like terrorism, example the 9/11 attack on the World Trade Centre in 2001 could cause a huge impact to both physical and humans entities. Thus, many studies have been conducted to evaluate the economic impacts by estimating possible losses to predict potential effects of a disaster in advance (Garrett, 2005; Karesh & Cook, 2005; Mileti, 1999). Natural disasters without doubts have a profound influence on the quality of life through their

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