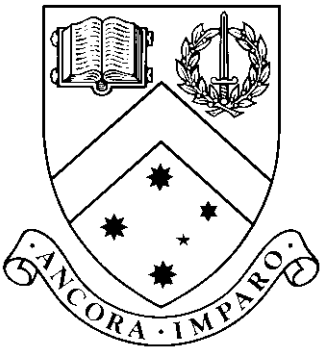
The Effects of Group Member's Parameters on Human Crowd Modelling

by

Viet Vo, BSc., MSc.



Submitted by Viet Vo

Supervisor: Prof. Bernd Meyer

Associate Supervisor: Dr. Aldeida Aleti

Caulfield School of Information Technology

Monash University

October, 2015

Contents

List of Tables

List of Figures

The Effects of Group Member's Parameters on Human Crowd Modelling

Viet Vo, BSc., MSc.
viet.vo@monash.edu
Monash University, 2015

Supervisor: Prof. Bernd Meyer
bernd.meyer@monash.edu
Associate Supervisor: Dr. Aldeida Aleti
aldeida.aleti@monash.edu

Abstract

This thesis introduces

The Effects of Group Member's Parameters on Human Crowd Modelling

Declaration

I declare that this thesis is my own work and has not been submitted in any form for another degree or diploma at any university or other institute of tertiary education. Information derived from the published and unpublished work of others has been acknowledged in the text and a list of references is given.

Viet Vo
October 9, 2015

Chapter 1

Introduction

Since over 70% of the world population is predicted to live in cities by 2050 (Weidmann, 2012), rapid urbanization and population growth will be inevitable challenges in the effort of planning infrastructure, estimating traffic needs and capacities, and increasing the safety of pedestrians. With the increase in the number of public events and the number of accidents during these events since the crush disaster happened at the Station Nightclub, USA (2003) (Evers, 2011), the demand for realistic crowd simulation models becomes important for risk management in urban design and crowd safety. To develop realistic simulation models, various studies have been conducted in order to understand and simulate behaviours which can emerge in both normal and emergency situations such as groups of pedestrians moving with or competing against each other.

Group cohesion behaviour is the behaviour of objects moving towards the average positions of their neighbors over the time (Reynolds, 1987). The definition of this behaviour was motivated by the visual observation of coherently flying objects. The behaviour has been investigated widely on the collective motion of different flocking organisms including homing pigeon flocks (Kattas, 2012), fish schools (Miller, 2013), and bacteria colony (Cisneros, 2007).

Human group cohesion behaviour is observed by its cohesion degree and formation. Cohesion degree denotes the average distance to the groups centre of mass from each group member while observable human group formations are V-like, line-abreast, U-like, or river-like (Helbing, 2005). Group cohesion behaviour is important in both normal and evacuation scenarios. In normal situations, group cohesion behaviour can affect the speed and movement direction of pedestrians who are not belonging to any group. In human behaviour research, the frequency of group cohesion behaviours occurrence has been observed at different places in the UK with the percentages of 37% at train station, 50% at shopping centre, 28% at university campus, 50%, at Clumber Street (Singh, 2009). Pedestrians in the same group might be family members, colleagues. In crowd disasters, pedestrians evacuate with group rather than escape individually. Groups of families and friends with strong ties, stay together and evacuate together have been emphasized through socio-psychological research area (Mawson, 2005). They may move irrationally to maintain its cohesion and consequently become obstacles for other pedestrians (Aguirre, 2011).

Chapter 2

Literature Review

In this chapter I will demonstrate some of the extended citation capabilities provided by the natbib package (?, ?). It replaces the standard LaTeX `\cite` command with two basic forms of citation command: `\citep` and `\citet`, as well as providing several other very useful ones.

The `\citep` command is best used when placing a citation at the end of sentence or phrase (as above). In the natbib documentation, this is referred to as a *parenthetical citation*.[1]

When you want to refer to the authors of a particular work, typically at the start of a sentence, a parenthetical citation is not appropriate. This is particularly so if you are using a numerical or symbolic citation style. You should *not* start a sentence with

> [2] says that this is most certainly ...

In such situations you really need to give the authors' names. The `\citet` command produces *textual citations*, which allows you to produce things like:

> Ade1983 describes a means by which textures may be characterized ... another approach is given in DeV1998.
>
> AGR1996 note that humans have little or no difficulty in perceiving shape, yet find it extremely difficult to *describe* what they perceive.

Note that an abbreviated version of the authors' names has been produced in the third example above. It is often desirable to have the full list of authors' names given when a work is first cited, and an abbreviated list thereafter. This can be achieved by passing the `longnamesfirst` option to natbib when the package is used. This will produce an initial citation like:

> *AGR1996 note that humans have little or no difficulty in perceiving shape, yet find it extremely difficult to *describe* what they perceive.

Both the `\citep` and `\citet` can take two optional arguments. If just one is provided, its text will appear as a "post-note" after the citation details. If two arguments are provided, the first defines a pre-note, and the second a post-note. Here is an example:

> `\citep[Ch.~3]{AaK1989}` ... [Ch. 3]AaK1989
> `\citep[see][Ch.~3]{AaK1989}` ... [see][Ch. 3]AaK1989

These examples only scratch the surface of what the natbib package can do. To discover the full power of the package, see the documentation at CTAN Dal1999. You probably already have it on your system. Try `locate natbib.dvi` at the command line.

[1] For ease of conversion from exisiting LaTeX documents, you might find it useful to place `\renewcommand{\cite}{\citep}` in the preamble of the document, since any existing standard `\cite` commands should almost certainly be treated as `\citep`.

Chapter 3

Figures and Tables

Here we will test that references to figures and tables work correctly.

3.1 Figures

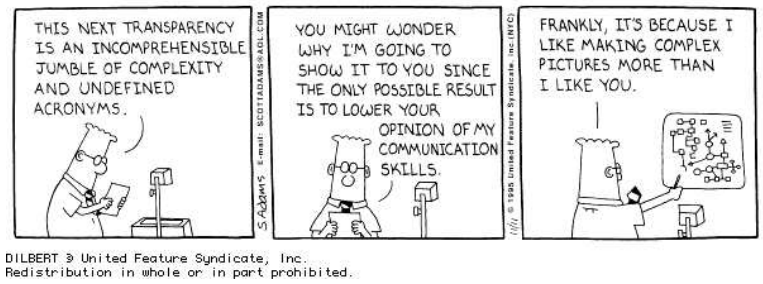


Figure 3.1: An example of a figure.

See Figure 3.1.

3.2 Tables

See Table 3.1.

3.2.1 Referencing test

See Table 3.1 and Figure 3.1.

23121	1212	232
cat	frog	dog

Table 3.1: An example of a table

Chapter 4

Method

Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua.

Appendix A

This appendix should get a letter

An appendix before the backmatter gets an automatically generated letter by which it can be referred to. This is Appendix A.

Appendix B

Simulation Source Code

You may want to investigate the `lgrind` program and package if you wish to include source code in your thesis

References

Aguirre, B. E., El Tawil, S., Best, E., Gill, K., & Fedorov, V. (2011). Contributions of social science agent-based models of building evacuation. *Contemporary Social Science: Journal of the Academy of Social Science*, 415-432.

Cisneros, H., K, Cortez, R., Dombrowski, C., Goldstein, & R.E, J., Kessler. (2007). Fluid dynamics of sell-propelled microorganisms, from individuals to concentrated populations. *Experiment in Fluids 43*, 737-753.

Evers. (2011). *Modelling crowd dynamics: a multiscale, measure-theoretical approach.* Master Thesis, Eindhoven University of Technology.

Helbing, B. L. J. A. W. T., D. (2005). Self-organized pedestrian crowd dynamics: Experiments, simulations, and design solutions. *Transportation Science*, *39 (1)*, 1-24.

Kattas, G. D., Ke., X. X., & M., S. (2012). Dynamical modelling of collective behaviour from pigeon flight data: Flock cohesion and dispersion. *PLoS Computational Biology*, *8*.

Mawson, A. T. (2005). Understanding mass panic and other collective responses to threat and disaster. *Psychiatry: Interpersonal and biological processes*, 95-113.

Miller, N., Garnier, S., Hartnett, A., & Couzin, I. (2013). Both information and social cohesion determine collective decisions in animal groups. *PNAS*, *110(13)*, 5263-5268.

Reynolds, C. (1987). Flocks, herd, schools. a distributed behavioural model. *Proceedings of the 14th annual conference on Computer Graphics and Interactive Techniques, ACM*, 34-55.

Singh, A. R. D. D. J., H. (2009). Modelling subgroup behaviour in crowd dynamics dem simulation. *Applied Mathematical Modelling*, *33(12)*, 4408-4423.

Weidmann. (2012). *Pedestrian and evacuation dynamics 2012*. Springer.

Last Thing

This sort of appendix has no letter.