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Two Agent-Based Models of Trust in Social Networks

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Abstract

Trust is a pervasive feature of human social interaction. Much of the recent interest in trust has been at the level of individuals and dyads. But trust is also important in networks, as it enables the formation and maintenance of social cooperation. Understanding this requires an understanding of how trust arises, functions, and is maintained within networks of people.

Developing understandings of how individual behaviours aggregate, and how they evolve within an environment that includes other individuals developing similar behaviours is a difficult task. One way that it may be approached is through computer simulation using agent-based models. This thesis describes the development of two agent-based models of trust.

Agent-based modelling is a novel method within the discipline of social psychology. The thesis first describes what agent-based modelling is, describes some of the situations in which it might be applicable, discusses how it might apply to modelling individuals in a social setting, and discusses the experience of developing the model.

The first model was based on a theoretical cognitive model of behaviour within a particular formal game that has been claimed to involve trust, the Investor Game. This model showed that a population in which all individuals are are pursuing similar optimal strategies does not generate any of the interesting behaviours that we would expect to see in real-world interactions involving trust and cooperation. This tends to suggest that modelling trust behaviours also requires modelling behaviours that are untrustworthy, and representing a full range of potential behaviours, including outliers.

The second model is based on a more naturalistic setting, on-line peer-to-peer trading through sites such as New Zealand's Trade Me, or eBay. In this model, individual traders carry characteristics that determine their reliability and honesty, and attempt to find effective strategies for identifying other traders' trustworthiness. This model suggests that, while providing traders with minimal guidance on strategies and allowing them to search for the best strategies may result in them finding effective strategies, this is not the only possible outcome. Somewhat surprisingly, effective trust strategies acted to contain unreliability, rather than dishonesty.

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Over the last six months or so, a lot of people came to the fore in helping me to finish. It simply wouldn't have happened without Linda Jones and Ian Evans stepping in to make sure that that happened. I am enormously grateful to both of them for going out on various limbs for me. I suspect that quite a number of other people may have been engaged in making that happen, particularly Margaret Tennant, Jackie Koenders, the DRC, and an anonymous reviewer. Most of that went on in the background while I continued to plug on with the manuscript, so I am sure that there are others whose efforts on my behalf I don't know about, which makes it difficult to be able to acknowledge them. If this was you, thank you too.

Particular thanks are due to Ian Evans who stepped in very late in the piece to provide enormous practical supervision assistance to me in turning a pile of chapters, of varying qualities, into something much more presentable. His calm assurance that it was going to be entirely possible to bring it together into a complete thesis turned the tide for me, and it has made a huge difference to the finished thesis. Ian's encouragement, combined with Linda and Ruth Tarrant's simple insistance that I would get it completed, gave me the encouragement to make it so.

The practical support of a bunch of other people have been vital. My family have provided both the material, social, and emotional support to enable me to write the thesis. Mum provided much financial support, and a place to stay and work for the last few months that enabled getting the whole document into shape. Mike provided encouragement and material support, particularly in the early stages. Sandy provided a home and a family, and solid, sane, and calm support through a couple of years when things went from mixed up, to shattering, to downright terrifying. Neither she nor the kids had too much idea how diabolical a doctoral student can be in the final stages before submission. Now they get to meet me all over again when I'm not a doctoral student any more.

Last, but not least, this research was supported by a Massey University Doctoral Scholarship, for which I am very grateful.

Foreword

In a previous life, prior to beginning to study psychology, I was an engineer as a designer and consultant in electrical power systems. When I first entered the study of psychology, it was pointed out to me that I'd probably find it a little different to engineering. That comment proved somewhat prescient. This thesis in many ways reflects a series of questions that struck engineer abroad in the social sciences.

Electrical engineering students spend an entire academic career understanding and manipulating systems that are composed of many elements. Entering psychology was jumping into a world that was largely dominated by the in depth understanding of single entities. Unlike engineering, in psychology understanding the individual wasn't simply an essential precursor to understanding the system.

Large as the difference in thinking in terms of individuals versus systems was, I found that the the most dramatic difference in thinking involved time. In fact, to an electrical engineer, time was all but missing in psychology. Almost universally, theory and analyses were entirely static. That may not have been entirely strange in itself, but the language that was being used to discuss phenomena drew frequently on words like increase, change, and intervention. Psychology, as an applied discipline, is largely concerned with bringing about change, but the thinking and analysis was in terms of static, that is, unchanging, phenomena.

My interest in trust grew out of an entirely different set of experiences, this time as a somewhat absent-minded foreign student in Indonesia. Talking to Indonesian people, I was struck at how low their expectations of the trustworthiness of their compatriots was. In part that was understandable, as the country is plagued with endemic corruption, and petty crime like pick-pocketing is common. But at a more personal level, I had the frequent experience of people returning my wallet when I had left it in local stores. Even more strikingly, I had left my ATM card in an ATM, with the PIN number punched in. Someone found it, and came across the road to the mall in search of me. I wondered how such low levels of generalised trust had become entrenched, when individual people had shown an extraordinary degree of honesty.

From the two puzzles came this thesis.

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