Modelling Social Learning of Adolescence-Limited Criminal Behaviour*

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1 Motivation

Within Criminology, the analysis of the emergence of criminal behaviour is one of the main challenges [4]. An important mechanism behind this emergence is social learning [3]. To analyse this mechanism, this paper presents an agent-based approach to simulate social learning, which specifically addresses the mutual influence of peers, parents and school, with respect to delinquent behaviour.

To formalise and analyse the emergence of criminal behaviour through social learning, an artificial society has been modelled to represent a small school class. The models for the agents have been formally specified by executable temporal/causal logical relationships, using the modelling language TTL [2] and its executable sublanguage LEADSTO [1]. This language allows the modeller to integrate both qualitative, logical aspects as quantitative, numerical aspects. Moreover, since the language has a formal logical semantics, simulation models created in TTL and LEADSTO can be formally analysed by means of logical analysis techniques.

2 Social Learning

According to the literature, two types of delinquents can be distinguished: *life-course-persistent* offenders, who stay criminal throughout their entire life and *adolescence-limited* offenders, who only show antisocial behaviour during adolescence. The latter, which is the topic of this paper, is caused by the gap between biological maturity and social maturity. It is learned from antisocial models that are easily mimicked, and it is sustained according to the reinforcement principles of learning theory.

An influential theory on the emergence of adolescence-limited criminal behaviour is the differential association theory, which was first proposed by [5] and later expanded by [3]. In short, this (informal) theory states that behaviour is learned through interaction with others. We learn most from the people we are in close contact with, like parents and peers. According to [5], the extent to which delinquent behaviour is imitated is influenced by the frequency, duration, and intensity of the contact. Frequent, long and important or prestigious contacts have a larger influence. In addition, the priority of learning influences the social learning process: the earlier behaviour is learned, the more influential it is.

3 Simulation Model

To study the influence of social learning on delinquent behaviour, we modelled a school class with 10 pupils. There are three groups that influence the process of social learning, namely parents, school and peers. Therefore, each pupil is represented as an *agent*; the parents of the pupils and the school are modelled as *groups*. Each pupil is related to one parent group. The agents have a number of characteristics in our model (determined based on discussions with experts). We restricted our study to the characteristics that are collected in an empirical study [6] that we will use in the future to validate our

* The full paper version of this paper was published in: Filipe, J., Fred, A., and Sharp, B. (eds.), Best papers of Agents and Artificial Intelligence 2009. CCIS, Springer Verlag, 2009, to appear.

model. The social relations between pupils in a school class are modelled via *attachment* relations. All agents are attached to each other with a specific level of attachment, representing the intensity of the contact as defined by [5]. The attachment relation is also used to model the attachment of pupils to their parents and to their school. We assume that a high attachment results in a higher influence of the attached agent or group on the behaviour of the pupil. Finally, we model a level of *delinquency* for all agents and groups, also for parents and schools. During the simulation, the levels of delinquency of the pupils change because of the influence of others. This process is depicted in **Fig. 1**, where the circles denote state properties and the arrows denote dynamic properties (relationships) between them.

4 Simulation Results and Analysis

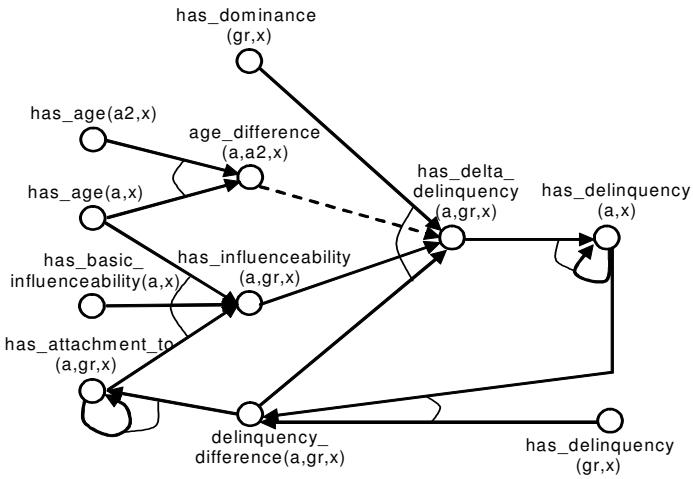

Fig. 1. Concepts and relations in the model.

A number of simulation experiments have been performed to see whether the behaviour of the model was as expected for some common scenarios. Although preliminary, the first results are promising. Firstly, they provide evidence that the proposed model is a useful experimental tool to give insight in social learning processes as described in the criminological literature. Secondly, some interesting patterns have already been found. For example, the simulation results suggest that the influence of the school on delinquency is relatively high, that the impact of attachment is relatively low, and that every individual learning process approaches a final delinquency near the average of the delinquencies of parents, school, and peers. To analyse the resulting simulation traces in more detail, the TTL Checker tool [2] has been used. A number of TTL properties have been checked against the generated simulation traces. Although no real conclusions can be drawn as yet, these checks pointed out that the traces satisfy basic properties that were inspired by criminological theories, such as 1) that the development of a pupil could be predicted by taking into account the delinquency of the parents and the school only, and 2) that a bad pupil in a class with many good pupils tends to move towards the good ones.

References

[1] Bosse, T., Jonker, C.M., Meij, L. van der, and Treur, J. (2007). A Language and Environment for Analysis of Dynamics by SimulaTiOn. Int. Journal of AI Tools, vol. 16, issue 3, pp. 435-464.

[2] Bosse, T., Jonker, C.M., Meij, L. van der, Sharpanskykh, A., and Treur, J. (2006). Specification and Verification of Dynamics in Cognitive Agent Models. In: Proceedings of the 6th Int. Conference on Intelligent Agent Technology, IAT'06. IEEE Computer Society Press, 2006, pp. 247-254.

[3] Burgess, R., and Akers, R.L. (1966). A Differential Association-Reinforcement Theory of Criminal Behavior. Social Problems, vol. 14, pp. 363-383.

[4] Gottfredson, M. and Hirschi, T. (1990). A General Theory of Crime. Stanford University Press.

[5] Sutherland, E.H., and Cressey, D.R. (1966). Principles of Criminology, 7th edition. Philadelphia: J.B. Lippincott.

[6] Weerman, F.M., and Bijleveld, C.C.J.H. (2007). Birds of Different Feathers. *European Journal of Criminology*, vol. 4, issue 4, pp. 357-383.