CAREER PATTERNS OF MEN AND WOMEN
A SOCIAL SIMULATION STUDY BASED ON CO-OPERATING NORMATIVE AGENTS

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1 Introduction

There has been growing interest in computer simulated social systems during the last years. This can be seen by the increasingly widespread literature dealing with that topic. Additionally an interdisciplinary research framework called SOCIONIC has been established in 1992 by the German Research Foundation (DFG).

Our research is based on a social simulation model established by Conte and Castelfranchi (1995, Castelfranchi, Conte and Paolucci 1998), who use their model to investigate the influence of social norms on aggression.

This model seems to be a good framework for a deeper understanding of the inequality between men and women in the more highly qualified job market.

Several authors dealing with gender inequality have pointed out that not only discrimination leads to inequality but also different behaviour-sets of men and women. There is a great conflict in gender research around this different behaviour hypothesis. It is still unknown if there are really gender-specific differences and how to explain the development of such differences if they are supposed to be found.

Additionally, most investigations of that problem are using qualitative data from field-studies. Thus it is also not clear if supposed differences between men and women really lead to inequality in career development and in getting jobs.

In this paper, the role of some different behavioural norms supposed for men and women and their effect on inequality and on being successful in artificial life will be explored.

In the following section we will first describe the simulation model of Conte and Castelfranchi and secondly the necessary changes of the model to adapt it for our investigation. Next we will be testing the correct implementation of the model by reinvestigating some main findings of Conte and Castelfranchi. This strategy follows a paper of Saam and Harrer (1999) who have also used the Conte and Castelfranchi model.

2 The Experimental Design

The artificial social model, implemented in C++, defines agents moving in a world of a 10 x 10 grid with randomly scattered food. The agents' greatest desire is to eat as much food as possible. But there are 50 agents in total and only 25 food items. Nevertheless there is a chance of getting food for all agents, because eaten food items are restored at a randomly chosen location immediately after eating.

Eating food increases the agents' strength, but every action is followed by a loss of strength. Successful agents will be able to eat more food than the others, therefore having a greater strength at the end.

An experiment consist of a set of 100 matches, each including 2000 turns. At the beginning of each term, every agent selects an action from six available routines: (1) MOVE-TO-FOOD-SEEN, (2) EAT, (3) MOVE-TO-FOOD-SMELLED, (4) AGGRESS, (5) MOVE-RANDOM, (6) PAUSE.

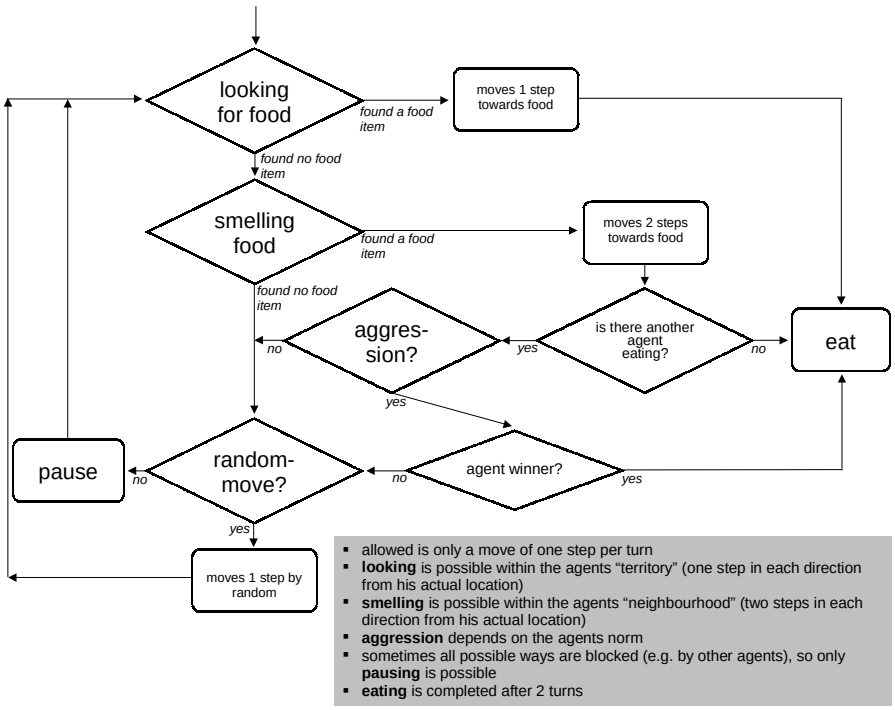

Figure 1

As can be taken from figure 1, aggression is only a possible option after a Move-to-Food-Smelled. If after such a move an agent encounters another agent

eating the food, the approaching agent will consider aggressing the eating agent, depending on his norm. The norm determines under which circumstances an attack will be executed (e.g. strategic norm: agents will only attack those eaters whose strength isn't higher than their own). The outcome of an attack is determined by the agents' strength. The stronger agent is always the winner. When the competitors are equally strong, the defender is the winner. See table 1 for available norms and the costs/benefits of all possible actions.

Cost/Benefits		**Norms**
Strength at start	40	norm 1: blind aggression: attack if possible
Move	1	norm 2: strategic: attack only if you stronger
Aggress/Defend	4	norm 3: male networking: do not attack members of your own group
Pause	1	norm 4: no aggression for food under agents level

Table 1

2.1 Differences Between the Conte – Castelfranchi – Model and the Present Study

Norm 1 and norm 2 (see table 1) were developed in the original work of Conte and Castelfranchi. Norm 3 to 6 have been designed for this study, according to literature on differences in behaviour between men and women (see below).

In their original model Conte and Castelfranchi chose a fixed nutritive value of 20 points per food item (if an agent has finished eating, his strength increases by 20 points). This didn't seem appropriate for our field (career development). We therefore implemented three different types of food with low-, medium- and high-level nutritive values of 10, 30 and 72 points respectively. In our artificial society there are 12 units of low-level, 8 units of medium-level and 5 units of high-level food item – 25 in total, which is the same number as in the original model.

Conte and Castelfranchi point out that it has to be supposed that all actions of the agents are simultaneous within one turn. But in fact computers do not work like this. In order to make sure that no agent gets a better chance, the starting agent and the ranking of the others are chosen by random before each turn.

2.2 Measurements

For each experiment (a set of 100 matches), the average strength and the standard deviation of strength were recorded separately for agents supposed to be men and women. The standard deviation is considered as a measurement of inequality; the larger the standard deviation, the less equitable the distribution of strength.

2.3 Replication

Before we started our experiments using our changed framework, we resimulated the original model to guarantee that we can reproduce the original results. As has been found by Conte and Castelfranchi, "blind aggression" is less effective and leads to higher inequality than the "strategic" norm. Our findings indicate the same, but on a lower level. Both average strength and standard deviation of strength are lower than in the original simulation for both norms. Nevertheless our replication results reproduce the original results qualitatively.

2.4 Men and Female Behaviour

Four norms have been designed for this study, according to literature on differences in behaviour between men and women.

Some aspects of typical male behaviour have been found to be more effective for career development. As a basis for defining norms 3 and 4, we drew on theoretical work about "Männerbünde" (the original German word "Männerbünde" (Rastetter, 1998) refers to a special form of male networks) and the tournament theory of Rosenbaum (1979, 1984).

In our framework it is not possible to take all aspects of male networks and tournament theory into account, but norm 3 refers to the basic logic of these "male circles", which are known to be highly cohesive networks between men established in secondary socialization (e.g. in student clubs).

The concept of "Männerbünde" also describes the situation relating to barriers encountered by women on their career path in management. The number of high positions in top-management is very small and it is difficult for women to break the "glass ceiling" and get a position in this area. The "Männerbund" as a basic element in management keeps up the male predominance through the exclusion of women. Women don't have the same access to building networks, have no experience how to develop informal networks and to establish contact with peers. For our simulation, the principles of male networks ruled out aggression of "male" agents against other "males" (norm 3).

Taking into account that the 3rd norm only refers to agents of the same group (no aggression against members of the own group) a norm will be needed for aggression against non-group members. Therefore norm 3 is combined one time with norm 1 and another time with norm 2.

Norm 4 bases on a finding of the tournament theory of Rosenbaum (one of the main theories of career development). The tournament theory bases on the assumptions of Social Darwinism. The basic dynamics of Rosenbaum's theory build on the human capital model (Becker & Gary 1964). The main statement of the tournament theory is that people invest in their own human capital and consequently in their own future careers. Rosenbaum suggested that it has a very positive influence on later career success to start with a job which is not below one's level of

skill. This refers to our 4th norm: agents will only attack to get food at the level of their strength. In order to implement the comparison of food level and strength level, the strength of all male agents are ranked and divided into three equal number classes (high, medium and low) every time an attack is possible. Therefore, before every possibility to attack, male agents know their own relative strength level and can compare it to the nutritive value of the food item.

Norm 1 and norm 2 are supposed to be neutral with regard to gender-specific behavior.

In order to test each norm against each other we developed 10 experiments, which can be taken from table 2:

Experiment	**Norm A**	**Norm B**	**Hypothesis**	**Significance**
Exp. 1.	1	2	*B is stronger*	*
Exp. 2.	1	3 (with 1)	*B is stronger*	*
Exp. 3.	1	3 (with 2)	*B is stronger*	*
Exp. 4.	2	3 (with 1)	*B is stronger*	*
Exp. 5.	2	3 (with 2)	*B is stronger*	*
Exp. 6.	3 (with 1)	3 (with 2)	*B is stronger*	*
Exp. 7.	1	4	*B is stronger*	*
Exp. 8.	2	4	*B is stronger*	
Exp. 9.	3 (with 1)	4	*?*	
Exp. 10.	3 (with 2)	4	*?*	

* $p < 0,01$

Table 2

3 Findings

As can be seen from Figure 2, norm 2 is stronger than norm 1. This result is still known from the original model of Conte and Castelfranchi. In comparison to our hypothesis, only norm 3 always leads to a higher (in some cases to a much higher) strength of the depending agents.

Norm 4 is only better than wild aggression (norm 1) and not different from strategic behaviour (norm 2). According to Figure 3, norm 4 leads always to higher standard deviations, which means that the distribution within this group is very polarised. In order to get a better insight into the data, Figure 3 was designed taking both into account, the mean value and the standard deviation of strength (mean divided by standard deviation). As can be taken from this Figure, norm 4 leads to very low values and really has no chance against “norm 3 combined with norm 2”.

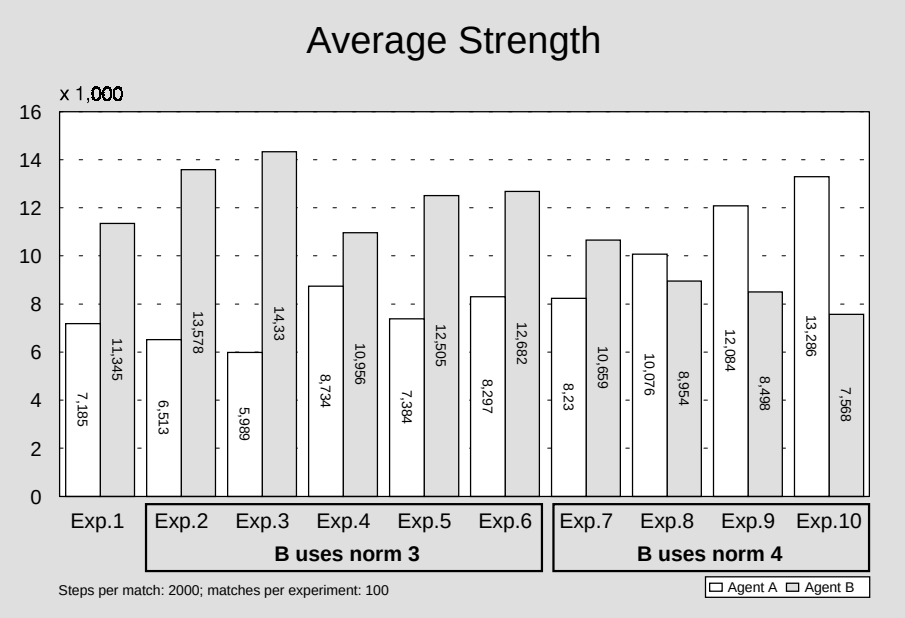

Figure 2

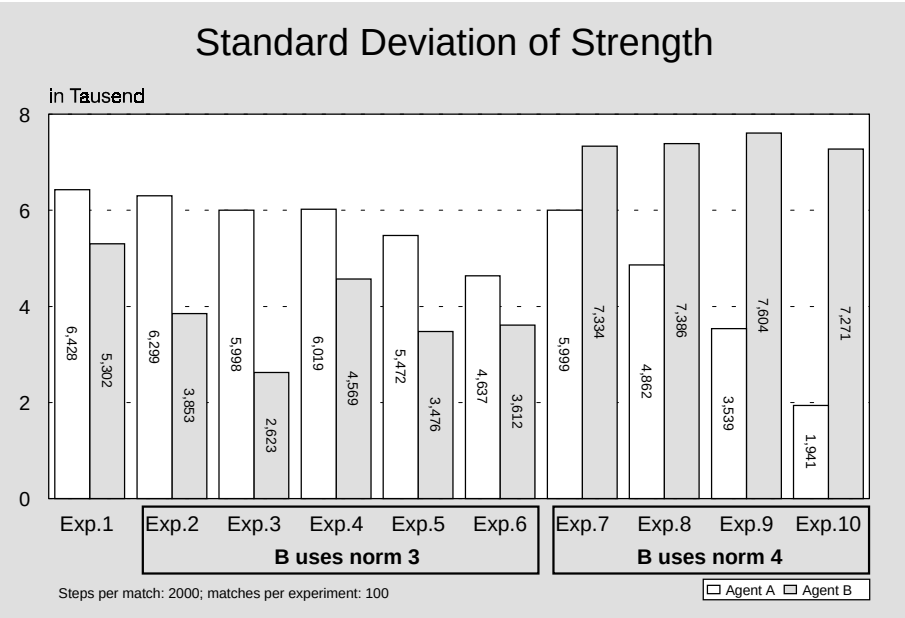

Figure 3

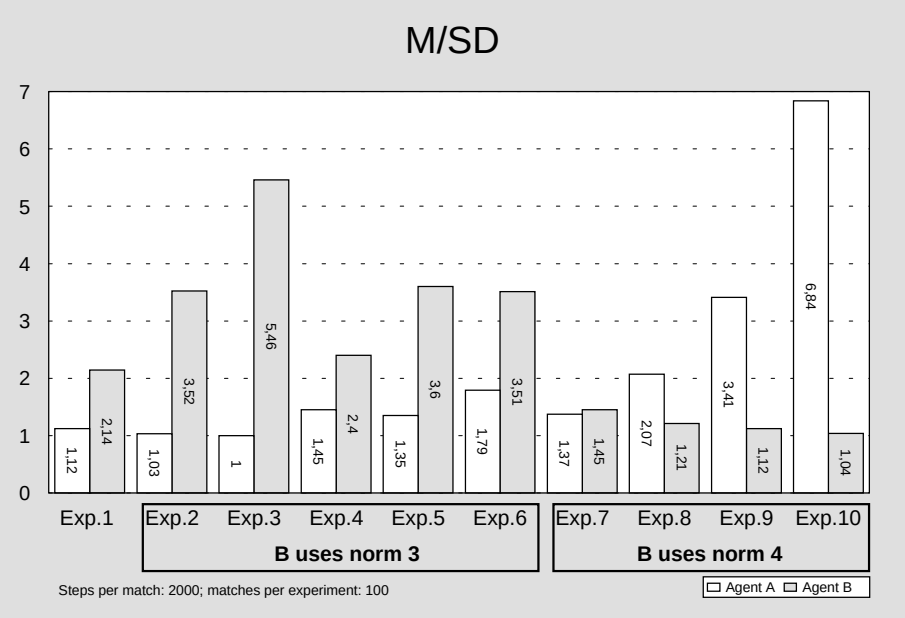

Figure 4

4 Conclusion

Our investigation on different behaviours of men and women using an artificial social model indicates that there are great differences in outcome depending on different behavioural norms. The hypothesis that male networking leads to higher strength than the other norms is supported by our findings, but we didn't expect our results to be that clear-cut.

On the other hand, sticking to norm 4 (no attack if nutritive value of food is below one's own strength level) doesn't seem to be a very promising way for getting strong.

5 References

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