NEG-O-NET VERSION 1.0 MODEL

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The Neg-o-Net model is a generic agent-based computational simulation model for capturing multi-agency negotiations concerning resource and environmental management decisions. The model is intended to be generic enough to be applicable to many regional applications with minimal re-programming. Neg-o-Net was developed by the Centre for Policy Modelling at Manchester Metropolitan University. The initial design was produced in collaboration with IP-CNR Rome partners.

1.1 Modelling Context

1.1.1 Description Domain Context

The model is a generic framework for simulating various multi-agency negotiation processes centred on resource and environmental management. Stakeholder "viewpoints" are represented as networks of states of the world and actions that are believed to move between those states. Each stakeholder (agent) has different (possibly conflicting) viewpoints and goals. Negotiation processes can be applied at three distinct levels – action trading (a kind of barter), belief exchange and goal exchange. In the current version (1) three simple negotiation protocols have been implemented along with example viewpoints – for illustrative purposes.

1.1.2 Original Purpose of Model

The purpose of constructing the model was to solidify some of the on-going theoretical discussions at previous FIRMA workshop meetings in Clermont-Ferrand, Oxford and Maastricht concerning the possibility of a "generic negotiation model" that could be tailored with minimal programming effort to specific partner areas. Consequently, the current model separates the agent "viewpoints" from the code by providing a simple "viewpoint description language" allowing for agent viewpoints to be described in a high-level and intuitive way.

The main purpose of version 1 was to demonstrate that such a generic model was possible and could be used by the FIRMA partners in collaboration with the Centre for Policy Modelling (CPM) for application to specific regional variations. This aim was achieved, and the CPM is currently working with the Maastricht group to tailor the model to that region's requirements. Specifically, to implement (at the viewpoint level of detail) the negotiation processes studied in detail by the Maastricht team involves government, citizen groups and gravel extractors. The Maastricht team have already produced a simulation model at the level of preferences to describe the process. A properly extended Neg-o-Net should allow for the explicit representation of the beliefs of agents and the dynamic negotiation process. This would allow the preferences to be "unpacked" into the underlying beliefs. For example, agents will be able to *give reasons* for disagreeing with proposed government plans and the government agent will attempt to reformulate plans to take account of this. These processes will be given as a natural-like language trace that should be understandable to anyone familiar with the domain.

Additionally, the model is to be integrated into the online Zurich Water Game (Gilbert et al 2001). Here, the agents will interact with people playing the game. Currently, the artificial agents in the game have fixed viewpoints, strategies and negotiation protocols but utilising the flexibility of the Neg-o-Net model should allow for these to be easily changed. This could offer future potential for knowledge elicitation – by allowing real stakeholders to negotiate with artificial agents and comment on their deficiencies as a realistic representation.

1.1.3 How was the Model Actually Used

The model has currently been used for demonstration purposes to the regional applications teams. Currently the CPM is working intensively with the Maastricht team to specialise the next version of Neg-o-Net to the negotiation processes identified in that region.

1.1.4 How the model relates to FIRMA's aims and objectives

The model allows the explicit representation of a negotiation between parties with given their different views as to what is possible in the world with respect to the relevant domain. It is specifically designed to facilitate its integration into models which combine other relevant aspects of the situation in each of the five regions. It is also designed with a view to the participatory elicitation of representations of the parties different views in terms of simple diagrams. Thus it forms a key part of analysing those hydrosocial issues of water management that include negotiated elements. It is the key core element that will enable the development of a somewhat generic model design, but one which is deeply relevant to the regions separate problems. Finally it is designed to facilitate the participatory integrated assessment in the five regions.

1.1.5 Relationship to other Models

The Neg-o-Net model was inspired by the Part-Net model (Conte & Pedone 1998) which in-turn was an extension of the Dep-Net model (Conte & Sichman 1995). Part-Net and Dep-Net were produced by the IP-CNR Rome modelling group and the SimCog group São Paulo. Neg-o-net was designed in consultation with the Rome group and is consistent with their developments in the area of social norm dynamics. A subset of goal level negotiation may be viewed as the spread of normative beliefs. This could be seen as the "top-level" stopping condition in the three levels of negotiation previously outlined. Specifically, if an agent wishes to convince another to adopt a high-level goal (for example "increase the quality of life of the citizens") for which it has no justifying higher-level goal then these may be considered as a form of institutional norm. In this context, theories of norm adoption would be applicable and capable of being integrated into the Neg-o-Net model should this be required (Pedone 2000).
Additionally Neg-o-Net leaves space for the integration of an environmental model (which would be produced by the regional application teams). In order to drive a simulated negotiation run (where actions are taken with environmental consequences and the results observed and reacted to) an environmental model is required. Future work may integrate the already developed Maastricht environmental model into the Neg-o-Net framework. At the end of a negotiation process agents submit the agreed actions to the environmental model, which then returns the environmental consequences of those actions.

1.2 Model Design

1.2.1 Intended interpretation

The model is descriptive. This means the interpretation is that of a dynamic description of the *kinds of* negotiation process that occur for given regional applications. The current non-specialised demonstration versions (1) gives an example of the kind of negotiation process descriptions that can be captured – but is not linked to any specific regional application. In this sense (as stated previously) version 1 of the model is a demonstrator and is currently being applied to regional applications.
The target phenomena are that of a multi-agency (stakeholder) negotiation dialogue and subsequent plans of action. Agents communicate in natural-like language their requests, proposals and suggestions, come to agreements and then take action. Each of these should correspond directly to real world stakeholder consultations and action plans at the descriptive level. Each agent has a viewpoint representing beliefs, goals and possible actions. These viewpoints should coincide with real stakeholder viewpoints at the given level of detail.
The aim of the model is *not* to be predictive in any narrow sense. We aim to produce traces of *plausible and possible* negotiation dialogues and action plans. The validation of the plausibility of the output should ultimately be directly from stakeholders with minimal mediation provided by modellers.
A well validated Neg-o-Net model applied to a regional application would offer some kinds of *wider predictive utility*. It may be possible to show that for given environmental assumptions, viewpoints and negotiation protocols, certain kinds of plan are *never possible* or unlikely. It might also be possible to show that certain disagreements are *inevitable* or likely. Given this, the ultimate aim of such modelling would be to computationally evaluate *new* negotiation protocols computationally and select or propose those which appear to increase the likelihood of desirable outcomes (policy advice) – though this is still a distant aim at present and beyond the scope of the current project.

1.2.2 Original Sources for Model Design

The general approach was inspired by the previous models Dep-Net (Conte & Sichman 1995) and Part-Net (Conte & Pedone 1998), although the emphasis is different from those models. The initial design process was carried out intensively with the IP-CNR Rome group. The Part-Net framework was extended to incorporate a three layered negotiation process and a digraph causal action/state viewpoint belief representation. In this scheme each agent stores their own viewpoint digraph based on their beliefs about states and actions. Arcs represent transitions between states (nodes). Each arc is labelled with some set of "actions" which are believed to produce movement between each node. Each node stores a world state description (including some set of environmental indicators) and some set of possible actions available to the agent holding the given viewpoint. Nodes are ordered by agents based on some desirability function – some weighted sum over state indicator values attached to each node.

1.2.3 Static Structure

In the current version (1) of the model the viewpoint digraphs stored by each agent do not change (in later versions, when belief and goal exchange is implemented, these structures will become dynamic). Figure 1 shows three example (essentially trivial and non-realistic) viewpoint digraphs. These represent the viewpoints of three agents (a manufacturing company, a political party and a citizens interest group).

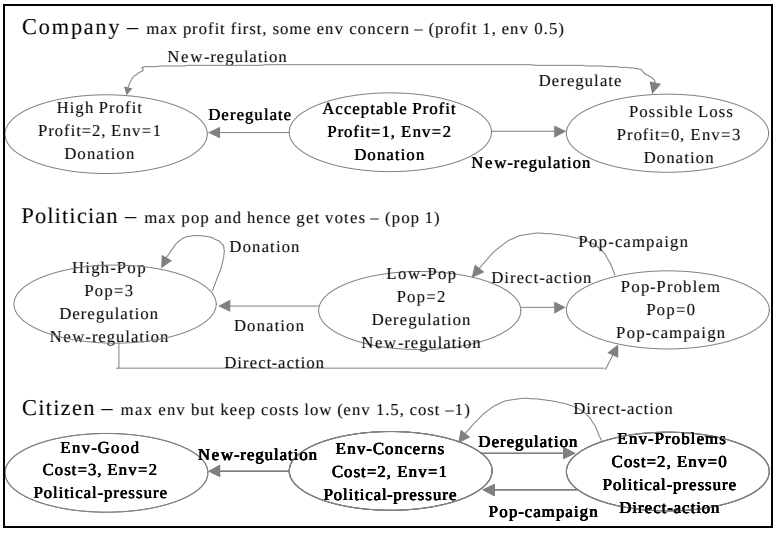

Figure 1. Some illustrative viewpoints (simplified fragments) for three agents. Note that each node contains a label, indicator values and a list of possible actions. Arcs are labelled with (believed) required action(s) to make transition to new state

In Figure 1, each agent has a viewpoint with only three nodes – this is a simplified example. The first text line listed at the top of each node is simply a label to identify the node – it should sum-up the world state concisely. The next line of text gives the values of indicators that the given world state represents. Each remaining line lists a possible action that the agent holding the given viewpoint believes it can take. Each arc is labeled with any actions (believed to be) required to move between states.

Note that for each agent in Figure 1, is listed a "weighting" of indicator values which defines their preferences over nodes. So, the company gives the "profit" indicator a weighting of 1, but the "env" (environmental concern) indicator only 0.5. This is just a short-hand way of capturing the notion that this particular company prefers profits over environmental concern but that such issues are not ignored and if significant could override profit. Obviously, the meaning of such weightings is only discernable when considered against the values placed on indicators in nodes of the agent viewpoint digraph. Costs and additional explanatory comments can be attached to actions and nodes but these are not shown in the figure.

These static structures are not hard-coded into the Neg-o-Net code but stored in a text file (in the form of a kind of high-level language) the text file input into Neg-o-Net that creates agents with the specified viewpoints. Figure 2 shows a fragment of the input file (the full input file is given in appendix 1 below).

```
#
# Neg-o-Net script - very simple viewpoint fragments
#

#==========

Agent:   Company  : The water company       # agent name and description

IndicatorWeights:profit 1 env 0.5          # weights applied to indicators

# now we have a set of nodes and links which belong to the agent

Node: Acceptable-Profit           : the company is in profit
Indicators: profit 1 env 2
Action: Donation                  : the company donates to the politician
Link: New-Regulation => Possible-Loss : the company moves to a possible loss
Link: Deregulation => High-Profit  : the company moves to high profit

Node: Possible-Loss               : the company is in a possible loss
situation
Indicators: profit 0 env 3
Action: Donation                  : the company donates to the politician
Link: Deregulation => High-Profit  : the company moves to high profit

Node: High-Profit                 : the company is in high profit
Indicators: profit 2 env 1
Action: Donation                  : the company donates to the politician
Link: New-Regulation => Possible-Loss : the company moves to a possible loss
```

Figure 2. Example fragment of input text file to neg-o-net.

1.2.4 Temporal Structure

In the current version dynamic change occurs in the believed current world states of each agent and during negotiation when agreements and offers are made and stored. In the context of Figure 1, this means that as the model is executed the believed world states (current node) for each agent changes over time. This change occurs based on agents attempting to move to “better” nodes – as defined by the weightings placed on the indicator values.

The process of attempting to move to “better” nodes often requires agents to look for other agents to perform required actions (if they do not have the ability to perform the action required themselves). For this “action haggling” to occur agents enter into a negotiation process. In the current version only one semi-plausible negotiation protocol is implemented. The model also implements (for comparison purposes) agents acting independently in addition to (again for comparisons purposes) agents acting in perfect unison, exploring all possible mutual action sets and maximising their joint preferences (which may or may not be meaningful depending on the scenario). Consequently there are three distinct ways that the current mode can interpret the viewpoint input file and produce output.

When agents negotiate they use two kinds of communication – broadcast (messages sent to all) and one-to-one (one agent sends another a message – no others can read the message). During a dialogue agents track and store any agreements made with other agents (concerning actions to perform). These agreements are then executed when no more negotiation is possible.

1.2.5 Important Parameters

As stated above, all the major parameters are stored in the viewpoint input file (see Figure 2). This includes, the number of agents, the viewpoints of each agent, the action repertoires at each believed world state, the indicator values and weightings and possibly action costs. Collectively this information defines the agent side (subjective side) of a “scenario”. The other important aspect of the scenario is the incorporation of an environmental simulation (produced elsewhere).

1.2.6 Initialisation

As stated above, the model is initialised via the viewpoint file (see Figure 2). Currently the negotiation protocols are hardwired but in future implementations these *could* possibly be placed into the file too.

1.2.7 Key Algorithms

The currently implemented negotiation protocol follows a process of repeated dyadic agreements concerning actions to perform. Essentially, agents broadcast to all other agents a list of requirements (actions that they want to be performed but which they themselves can not perform alone) and a list of possible offers (actions they are able to perform). The offers are broadcast one-by-one throughout the negotiation rather than in one block at the start. The idea here is that agents are happy for others to know what they want, but would rather not let all agents know what they could supply until this is required to make a deal. This way, the least costly actions can be offered first.

If an agent sees an offer that satisfies one of its requirements then it directly communicates with the offering agent. If the offering agent still has outstanding requirements it will ask for a deal based on this. If an agreement is made between two agents to perform certain actions, this is broadcast to all other agents. In this way all deals are transparent (there are no secret deals). Agreements, once made, are always honoured. Agents stop negotiating when they can no longer satisfy any more requirements. When all agents have stopped, agreed actions are performed.
Essentially then, agents simply form paired (dyadic) agreements to perform actions that are mutually beneficial. Agents only agree to perform actions that they believe will take them to a better node (based on their viewpoints, the actions they have decided to take and any announced agreements).
Note, as stated previously, this negotiation protocol was implemented purely as a "first example" of the kinds of possible protocols (or strategies) that could be implemented based on feedback from regional application partners.

1.2.8 Description of Model Dynamics

The dialogue consists of requests, offers and acceptances of action by the various parties. The dialogue represents a collective progressive exploration of the parties' belief nets for possible ways to improve their indicators (which represent their goals). Each time a particular possible pathway is blocked others are tried. The process stops whenever a set of actions is agreed. These actions then change the situation and the negotiation may begin again.

1.2.9 Implementation details necessary to get the simulation to run but not considered important for the results

There is little that is 'extra' in this model, since it is fairly simple. However it is likely that the exact order and extent in which agents consider their own belief nets will not always be significant to the results, but this needs to be confirmed with respect to the chosen object domains.

1.2.10 Implementation Language

The model is implemented in Sun Java2 JDK1.3.1. All necessary libraries are packaged into the JAR file. Additionally the model has been implemented in SDML. This "duel" implementation approach allows for flexible experimentation and exploratory investigation (SDML) and rapid execution, cross-platform compatibility and easy interfacing with other (e.g. environmental) models (Java).

1.2.11 Source Code

The executable JAR that also includes the source codes (plus rudimentary documentation) is available at http://www.davidhales.com/firma/negonet.

1.3 Conclusions

1.3.1 Example Simulation Output

Figure 3-Figure 5 below show some of the actual output produced during a negotiation process based on the viewpoints shown in Figure 1. Iterations are produced of perception (agents locate their current node), negotiation (make offers, post

```
>>> Iteration 1

Perception phase:
-----------------
The water company (Company):
 the company is in profit (Acceptable-Profit)
The politician (Politician):
 the politician has a low popularity (Low-Pop)
The citizens (Citizen):
 the citizens have concerns about the environment (Env-Concerns)

Negotiation phase: The agents are attempting some coordination of actions via haggling
-------------------------------------------------------------------------------------
    agent Company says to all: I require action Deregulation. Can anyone help?
    agent Politician says to all: I require action Donation. Can anyone help?
    agent Company says to all: I can offer action Donation.
    agent Politician says to agent Company: will you agree to do actions { Donation } ?
    agent Company replies: only if you can offer actions { Deregulation } in return.
    agent Politician says to agent Company: Okay, I can do that
    agent Politician says to all: I have agreed to perform action(s) { Deregulation }
    agent Company says to all: I have agreed to perform action(s) { Donation }

Action phase:
-------------
The water company (Company):
 the company donates to the politician (Donation)
The politician (Politician):
 the politician secures deregulation (Deregulation)
```

Figure 3. Example output from Neg-o-net model (I)

```
>>> Iteration 2

Perception phase:
-----------------
The water company (Company):
 the company moves to high profit
 the company is in high profit (High-Profit)
The politician (Politician):
 donations will help popularity
 the politician has a high popularity (High-Pop)
The citizens (Citizen):
 the citizens think deregulation will lead to problems
 the citizens are deeply concerned about environmental problems (Env-Problems)

Negotiation phase: The agents are attempting some coordination of actions via haggling
-------------------------------------------------------------------------------------
    agent Politician says to all: I require action Donation. Can anyone help?
    agent Politician says to all: I'm getting nowhere, I retract my previous offers and requirements!

Action phase:
-------------
The citizens (Citizen):
 the citizens take direct action (Direct-Action)
```

Figure 4. Example output from Neg-o-net model (Ii)

```
>>> Iteration 3

Perception phase:
-----------------
The water company (Company):
 the company is in high profit (High-Profit)
The politician (Politician):
 direct action by citizens will lead to low popularity
 the politician has a very low popularity (Pop-Problem)
The citizens (Citizen):
 direct action is sometimes necessary
 the citizens have concerns about the environment (Env-Concerns)

Negotiation phase: The agents are attempting some coordination of actions via haggling
-------------------------------------------------------------------------------------

Action phase:
-------------
The politician (Politician):
 the politician tries a popularity campaign (Pop-Campaign)
```

Figure 5. Example output from Neg-o-net model (Iii)

requirements and form agreements) and actions (agents perform agreed actions). Note, for the given viewpoints and implemented negotiation protocol, this output is not meant to represent any actual real negotiation process but is given as an example of the kind of process that can be captured by the model.

1.3.2 Results claimed as significant

The significant result obtained from Neg-o-Net version 1, is illustrated by the textual negotiation trace (see Figure 3 to Figure 5) and its relationship with the viewpoint representation. From a fairly loose and intuitive viewpoint representation (see Figure 1) multiple agents can negotiate at the level of actions in a way that is understandable to those with knowledge of the domain. As stated previously, the model is a point of departure for producing more specialised and realistic neg-o-net versions that suit different regional applications.

1.3.3 Methodological Lessons

This initial version of neg-o-net was produced to solidify discussions concerning the possibility of a generic negotiation framework from which regional applications could be derived. In this sense it is part of the first iteration, whereby the model is presented to the regional groups with domain expertise for their area and then modifications are made. At this stage, this method of development appears to be productive. However, in order to produce suitably specialised models, several iterations will be required requiring close liaison with the regional partners.

1.3.4 Future Development

As stated in previous sections the next version of the model is being developed for the Maastricht regional application. This will involve a "government agent" which produces plans, and a set of stakeholder agents that comment on those plans. The government agent modifies the plans based on the stakeholder response – effectively incorporating stakeholder beliefs into its own viewpoint. Here then, a kind of "second order" knowledge will be stored by the government agent – knowledge about others beliefs. The negotiation process will involve iterations of government plans and stakeholder objections or suggestions, terminated when no further change is possible or when some maximum number of iterations has been executed. Additionally, viewpoints will be broken-up into a number of independent and concurrent digraphs that relate to specific issues (e.g. risk of flooding, cost to consumer, environmental impact etc.). It has been evident that a single digraph is not a sufficiently compact representation when there are several issues that need to be considered simultaneously. The graphs become horrendously large due to the combinatorial explosion for considering each possible world state and action.

1.3.5 Published works relevant to the model

For a rough lineage leading to Neg-o-Net version 1 see Dep-Net (Conte & Sichman 1995) then Part-Net (Conte & Pedone 1998). However, these models have different aims. For a previous negotiation model applied to the same context but with a different approach see Moss (2002).

Conte, R. & Sichman, J. (1995), DEPNET: How to benefit from social dependence, *Journal of Mathematical Sociology*, 1995, 20(2-3), 161-177.

Conte, R. and Pedone R. (1998), *Finding the best partner: The PART-NET system*, MultiAgent Systems and Agent-Based Simulation, Proceedings of MABS98, Gilbert N., Sichman J.S. and Conte R. editors, LNAI1534, Springer Verlag, pages 156-168.

Moss, S. (2002), *Challenges in agent based social simulation of multilateral negotiation*, Socially Intelligent Agents: Creating Relationships with Computers and Robots, Kluwer, pages 251-258.

Gilbert et al (2001), *Computer Simulation and Participatory Research*, Talk Presented at the SIMSOC-V workshop, September 2001, available at: http://www.soc.surrey.ac.uk/simsoc5/talks-page/talk05.htm.

Pedone et al (2000), *Social & Institutional Influence - Why people accept policies*. Available at: http://firma.cfpm.org/partners/internal-reports.html

1.4 Appendix 1

The full listing (actual input file to neg-o-net) capturing the example shown in figure 1 of which Figure 6 shows the first few lines.

```
#
# Neg-o-Net script - very simple viewpoint fragments
#
#==========
Agent:      Company              : The water company          # agent name and description
IndicatorWeights:    profit 1 env 0.5                        # weights applied to indicators
# now we have a set of nodes and links which belong to the agent
Node:                Acceptable-Profit                       : the company is in profit
Indicators:          profit 1 env 2
Action:              Donation                                : the company donates to the politician
Link:                New-Regulation => Possible-Loss         : the company moves to a possible loss situation
Link:                Deregulation => High-Profit             : the company moves to high profit
Node:                Possible-Loss                           : the company is in a possible loss situation
Indicators:          profit 0 env 3
Action:              Donation                                : the company donates to the politician
Link:                Deregulation => High-Profit             : the company moves to high profit
Node:                High-Profit                             : the company is in high profit
Indicators:          profit 2 env 1
Action:              Donation                                : the company donates to the politician
Link:                New-Regulation => Possible-Loss         : the company moves to a possible loss situation
#==========
Agent:               Politician   : The politician
IndicatorWeights:    pop 1
Node:                Low-Pop                                 : the politician has a low popularity
Indicators: pop 2
Action:              Deregulation                            : the politician secures deregulation
Action:              New-regulation                          : the politician secures new regulations
Link:                Direct-action => Pop-Problem            : the politician has popularity problems (very low)
Link:                Donation => High-Pop                    : donations will help popularity
Node:                Pop-Problem                             : the politician has a very low popularity
Indicators:          pop 0
Action:              Pop-Campaign                            : the politician tries a popularity campaign
Link:                Pop-Campaign => Low-Pop                 : the popularity campaign as done some good
Node:                High-Pop                                : the politician has a high popularity
Indicators: pop 3
Action:              Deregulation                            : the politician secures deregulation
Action:              New-regulation                          : the politician secures new regulations
Link:                Direct-Action => Pop-Problem            : direct action by citizens will lead to low popularity
Link:                Donation => High-Pop                    : continuing donations are appreciated
#==========
Agent: Citizen       : The citizens
IndicatorWeights:    cost -1 env 1.5
Node:                Env-Concerns                            : the citizens have concerns about the environment
Indicators:          cost 2 env 1
Action:              Political-Pressure                      : the citizens use political pressure
Link:                Deregulation => Env-Problems            : the citizens think deregulation will lead to problems
Node:                Env-Problems                            : the citizens are deeply concerned about environmental
problems
Indicators:          cost 2 env 0
Action:              Political-Pressure                      : the citizens use political pressure
Action:              Direct-Action                           : the citizens take direct action
Link:                Direct-Action => Env-Concerns           : direct action is sometimes necessary
Link:                Pop-Campaign => Env-Concerns : the citizens respond to the popularity campaign
Node:                Env-Good                                : the citizens are happy with the environment
Indicators:          cost 3 env 2
Action:              Political-Pressure                      : the citizens use political pressure
```

Figure 6. Example Neg-o-net output

1.5 Appendix 2. Neg-o-net Version 2

After discussions with the Maastricht group concerning their case study, it was decided to add a new negotiation protocol to negonet. This would more closely reflect the actual process studied by the group. A form of “Policy agent mediated” negotiation was implemented in which stakeholder agents make proposals to a Policy agent. The agent assesses these and proposes plans back.

The Policy agent has preference weights over the other agents. It proposes plans to the agents to maximize preferences. Agents respond indicating their own satisfaction levels based on their preferences and any actions that they can perform. The Policy agent then extends / updates its

viewpoint to include these – i.e. it learns. So the Policy agent can start with an empty viewpoint and induce one from dialogues with agents. Figure 1 shows a schematic of the communication structure in Negonet version 1 and Figure 2 shows the contrasting structure for Negonet version 2. Figure 3 shows example output from the first iteration of negotiation with Negonet version 2 with the same input script as given previously.

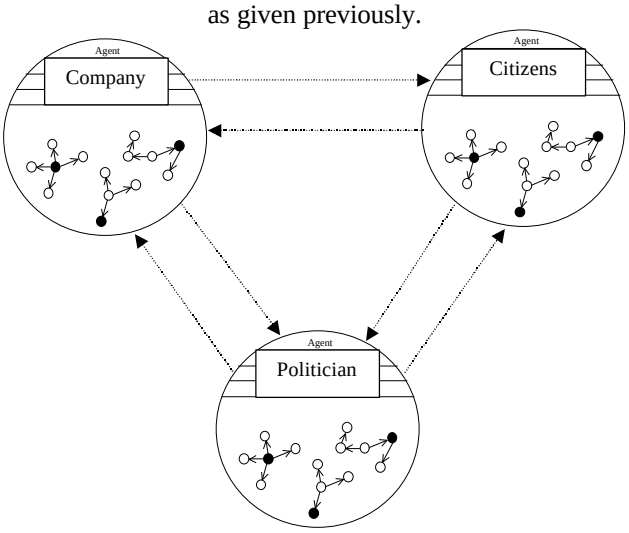

Figure 7. Negonet version 1, negotiation structure

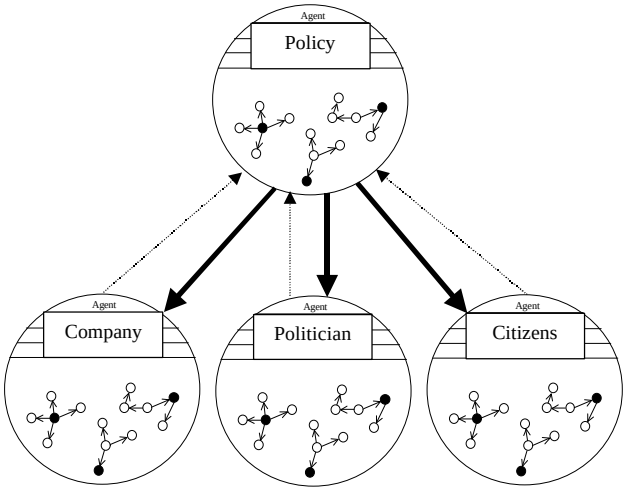

Figure 8. Negonet version 2, negotiation structure

```
Perception phase:
-----------------
The policy agent (Policy):
 the policy agent considers the situation (Do-Nothing)
The water company (Company):
 the company is in profit (Acceptable-Profit)
The politician (Politician):
 the politician has a low popularity (Low-Pop)
The citizens (Citizen):
 the citizens have concerns about the environment (Env-Concerns)
Negotiation phase: The policy agent is mediating a negotiation process
-------------------------------------------------------------------------------------------
The policy agent (Policy) says to all:
 we propose plan: no actions are taken { none }
The water company (Company) says to the policy agent:
 we are not happy with the proposed plan
 we propose that the company moves to high profit { Deregulation }
The politician (Politician) says to the policy agent:
 we are not happy with the proposed plan
 we propose that donations will help popularity { Donation }
The citizens (Citizen) says to the policy agent:
 we have no futher proposals
 we are happy with the proposed plan
The policy agent (Policy) says to all:
 we propose plan: donations will help popularity { Donation }
The water company (Company) says to the policy agent:
 we have no further proposals
 however, we refer to our previous proposals
The politician (Politician) says to the policy agent:
 we have no further proposals
 we are happy with the proposed plan
The citizens (Citizen) says to the policy agent:
 we have no further proposals
 we are happy with the proposed plan
The policy agent (Policy) says to all:
 we propose plan: the company moves to high profit { Deregulation }
The water company (Company) says to the policy agent:
 we have no further proposals
 we are happy with the proposed plan
The politician (Politician) says to the policy agent:
 we have no further proposals
 however, we refer to our previous proposals
The citizens (Citizen) says to the policy agent:
 we are not happy with the proposed plan
 we propose that no actions are taken { none }
The policy agent (Policy) says to all:
 we have no more proposals to make
The policy agent (Policy) says to all:
 we have considered your responses and we propose that donations will help popularity
Donation }
Action phase:
-------------
Policy agent says to Company agent: please perform action Donation
Company agent says to Policy agent: OK.
```

Figure 9. Example output from negonet version 2