

Exploiting Agent Technology Problem Solving Method to Model the Relationship between Legislative Drafting and Law-making Actors

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ABSTRACT

The relationship between the actors in the law making process is governed by the doctrine of separation of powers. Scholarly literature state that each of these actors is interdependent on the other and no single agency is able to exercise complete authority. The doctrine, however, can be extended to enable the three branches to act as checks and balances on each other. The study inquires into how the relationship between and amongst the actors in the legislative process covering both the legislative drafting (not covered under the doctrine of separation of powers) and the lawmaking processes can be modelled without infringing on the doctrine of separation of powers.

We analyse the application of artificial intelligent approach to modelling and propose the application of agent technology in modelling this relationship.

Keywords: *Artificial intelligence, agent technology, doctrine of separation of powers, law making, legislative drafting, legislative process, multi-agent system*

1. INTRODUCTION

Most of the analysis tools that have been used for problem solving in the legal domain have tended to incorporate Artificial Intelligence (AI) methods and techniques in their system design [6]. AI requires systems that possess the relevant domain knowledge and environment and can reason effectively in order to fulfill specific tasks, knowledge representation and reasoning applicable in intelligent systems, reasoning about beliefs and actions and domain applications [25].

Russell and Norvig [19] view an agent as anything that perceives its environment through sensors and acts upon that environment through effectors; while Park et al [17] define an agent as a software component capable of flexible autonomous operation in a dynamic, unpredictable and an open environment.

An agent may also be defined as a computer system that is situated in some environment and is capable of autonomous action in this environment in order to meet its design objectives; and a collection of such agents situated together in an environment and capable of interacting with one another is known as multi-agent systems [9][10][11].

According to Handi [8], an agent is a collection of knowledge and methods intended to embody a well defined functionality; cooperate in solving a problem by contributing to various parts of the problem process; are independently modifiable; well-focused on their tasks; often easier to design and develop; and are viable. In order for these entities to be deemed as intelligent, Jennings and

Wooldridge [9] contend that there are a number of capabilities that we would expect such entities/agents to possess, namely:

- a. Reactivity: intelligent agents are able to perceive their environment, and respond in a timely fashion to changes that occur in it in order to satisfy their design objectives;
- b. Pro activeness: intelligent agents are able to exhibit goal-directed behavior by taking the initiative in order to satisfy their design objectives;
- c. Social ability: intelligent agents are capable of interacting with other agents (and possibly humans) in order to satisfy their design objectives.

An agent technology is a natural extension of current component-based approaches, and includes distributed planning, decision making, automated auction mechanisms and learning mechanisms [9].

In applying agent technology to the Uganda's legislative process, following the arguments in [4][5][23]the relationship between the legislative drafting and law making actors (legislative process) may need to be derived as follows:

- a. The Executive generates policy for purposes of a given legislation, in principle;

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- b. The drafting process in translating the policy into legislation does not change policy but may re-direct it with the consent of the Executive;
- c. The Executive endorses the drafting output and implements laws as passed by the Legislature;
- d. The Draftsman's output, as endorsed by the Executive, is vetted by the Legislature and passed as law. Any non-compliance, subject to Parliamentary proceedings[2], is obtained as amendments or matters for clarification to the draft bill, for the attention of the Executive; and
- e. The Judiciary interprets the law passed by the Legislature.

The relationship between the law making actors is guided by the doctrine of separation of powers. Wells [22] in defining the doctrine of separation of powers made a contrast between the functions of each of the arms of government – Legislature, Judiciary and Executive, to the effect that:-

- a. The legislative function is essentially prospective, prescriptive and general; that is, legislation decrees that from a certain time, all persons in relevant circumstances will behave in the way the legislation stipulates;
- b. The judicial function is essentially retrospective, determinative and specific, that is, at a certain time in the past, a person or group of persons behaved in a way that breached the law; and
- c. The executive function is to execute - implement the passed legislation.

These three arms of government are to execute their functions independently yet interdependently without usurping each other's role and Wells [22] refers to this relationship as a symbiotic relationship, just like that of the architect and the builder, wherein there is no threat to construction standards, yet sees the threat coming to have the builder altering the architect's designs or for either the builder or the architect to be in cosy relationship with the building tribunal. This relationship works on the principle of Mutual Restraint in exercising these constitutional roles as enunciated in the Privy Council Case of *Prebble v. Television New Zealand* (1994).

1.1 Relationship Between Legislative Drafting And The Law Making Process

Legislative drafting can be defined as a process that involves problem solving and decision making aimed at the enactment of legislation; and is therefore, a component process in law making [2].

According to Spindler, [21], the doctrine of separation of powers, for purposes of the law making process, divides the institutions of government into three branches: the legislature makes the law; the executive puts the laws into operation; and the judiciary interprets the law. Each of these agencies is interdependent on the other and no single agency is able to exercise complete authority. The doctrine can be extended to enable the three branches to act as checks and balances on each other.

Although some scholars contend that judges make law, Crabbe [4] is of the view that a draftsman who defines a word which calls for judicial interpretation in order to give that word a more definite meaning makes a mockery of the doctrine of separation of powers.

According to Crabbe [4], the judiciary does not and should not participate in the law making process; and litigation should not be used as an instrument to make the law certain. He, however, cautions that the draftsman's freedom to usage and definition of words and in the interpretation section of a bill is subject to determination by the courts.

The two foregoing definitions contribute to and form the basis of the legislative process. Crabbe's definition underscores the role legislative drafting plays in the legislative process; while Spindler's definition focuses on the entire legislative process guided by the doctrine of separation of powers.

However, both contributing definitions are to co-exist and are pertinent in modeling the proposed relationship.

This study therefore, seeks to model this relationship; between and amongst the actors in the legislative process without infringing on the doctrine of separation of powers, from the legislative drafting perspective through the application of agent technology.

2. LITERATURE REVIEW

2.1 Overview of Legislative Drafting Process

Driedger, in Dollo [5]), contends as follows:-

- a. It is not the function of a draftsman to either originate or determine legislative policy. However, the dividing line between policy and law, between form and substance, is not a

sharp one and the draftsman cannot escape being involved in policy discussions.

- b. Although the draftsman is not responsible for policy, he/she must nevertheless consider whether the prescribed policy is capable of implementation because not all social ills can be cured by legislation; and he must critically examine the policy he has been asked to express in legislative language, not as a draftsman, but as a lawyer.
- c. In translating policy to legislation, the draftsman should note that his/her input should conform to the fact that, Parliament makes the laws and the Judiciary interprets them. When Parliament legislates, the role of the judiciary is confined to ascertaining from the words what Parliament has approved as expressing its intention, what that intention was, and to giving effect to it.

A good draftsman, therefore, has to keep abreast with how the courts interpret legislation. This knowledge empowers the draftsman and enables him or her to draft clearly and express the intention of the sponsoring department or Parliament [5].

From the foregoing contention, it can therefore, be deduced that whether directly or indirectly the drafting process has an influence on the workings of the law making actors and this relationship can be theoretically modeled and validated using agent technology.

2.2 Drafting Instructions and the Legislative Scheme

In principle, the Executive generates and develops policy for an intended legislation and the instruction to have the said policy translated into legislation comes by way of a drafting instruction by the Executive to the Draftsman.

Drafting instructions are a major input into the legislative drafting process, wherein the draftsman derives clarity on what the proposed legislation requires. It is from the drafting instruction that a legislative scheme (architectural plan), which represents the draftsman's mental picture or representation of the structure, quality, substance and form of the proposed legislation is designed [4]. Accordingly, the schematic representation is an outline for the achievement of the objectives of the proposed legislation which should demonstrate whether or not the proposed legislation is a workable piece of legislation and whether the tasks of the courts (Judiciary) will be made easier in the construction of the proposed legislation as a whole.

The drafting process is built on the basic unit of language - a sentence, which constitutes the provision to sanction, prohibit, mandate or even protect a given right.

Every provision of a bill thus must constantly, where applicable, address the questions of: 'who', 'when', 'where', 'why', 'which' and 'how' aspects of the bill [4]. Complying with all these questions may raise other questions and Crabbe [4] contends that a satisfactory answer to these raised questions would address the objectives of the intended law, the essence of which are tabulated in Table 1.

Table 1: Aspects of a bill

	Question	Scope
a.	How	Manner in which the law is to operate, and work
b.	What	Nature of legal action (legal predicate). May also refer to what is required to be done or that which is prohibited
c.	When	Conditions under which the law is to operate or upon which the operation of the law would depend
d.	Where	Circumstances in which the law would operate
e.	Who	Person on whom is placed the responsibility to act or on whom is placed an obligation or a prohibition not to act
f.	Why	Policy considerations for the formulation of the proposed law and the necessity for the proposed legislation

2.3 Artificial Intelligence and Agent Technology

Artificial Intelligence (AI), also referred to as computational intelligence [16] or rational agents has been defined as the study of intelligent agents, where an intelligent agent is a system that perceives its environment and takes actions which maximize its chance of success [19]. The goal of artificial intelligence as a science is to make machines do things that would require intelligence if done by humans [14] wherein AI is conceptualized as the field of computer science concerned with developing machines that behave in a way that would be considered intelligent if observed in humans.

Engle [6] is of the view that the best test of AI would be whether the AI can emulate both creative and linear computational tasks, and then integrate these two processes to allow solution to new problems which are similar to, but not the same as existing solved problems.

Wooldridge [25] contends that trends in AI have gone from building intelligent entities to producing useful tools through the use of agent technology to aid problem solving in a given domain; and in the legal domain, these tools have been used to support decision making and information management involved in legal reasoning.

However, agents are limited by their own nature in that in order for them to think rationally, they need to be aware of the environment they inhabit which requires knowledge representation. They need to be able to reason about this knowledge in order to act rationally and fulfill their task. That means they cannot be expected to generate their own knowledge for executing tasks [9][10][11].

Needless to say, since agents have the ability to coordinate assigned activities or tasks, communicate with each other and carry out autonomous operations, their application in modeling the relationship between the law making and the legislative drafting process, can therefore, be achieved without breaching the principles enshrined under the doctrine of separation of powers in relation to the law making process.

Wooldridge [25] is of the view that agent technology has been used to support decision making and information management involved in legal reasoning; and similarly, Yaskawa and Sakata [26] view these intelligent agents as having both the problem solving and learning skills as well as the knowledge for that purpose. Further, an agent being a computer system situated in some environment and capable of autonomous action in a given environment in order to meet its design objective, has the ability to act independently and can be designed to have control over its own actions and internal state [25].

An analogy on the notion of autonomy with respect to agents and encapsulation to object oriented systems has been made by Wooldridge [25] - an object encapsulates some state and has some control over this state in that it can only be accessed or modified through the methods that the objects provides. However agents, which also have the ability to encapsulate behavior in addition to state, unlike objects, does not invoke methods (actions or functions) on agents but requests actions to be performed.

Wooldridge [25] further contends that the strength of the agent system which distinguishes it from any other related software such as object oriented systems, distributed systems and expert systems are the attributes of autonomy and flexibility, encompassing responsiveness, proactiveness and sociability/interactivity.

2.4 Relationship and Roles of the Legislative Process Actors in a Multi-Agent System

According to MacCormick [13], systems ought to adopt a more realistic view of the law (outcome of legislative drafting process) for law is not self-contained and autonomous; instead its meaning must be interpreted in the light of many implicit and ever changing assumptions in the political and social context. Minsky [14] notes that intelligent behavior presupposes a background of cultural practices and institutions which must be modeled if computer representations are to have meaning.

Legal knowledge representation is said to involve the operation of interpretative processes whereby the formal sources of part of a legal system are scrutinized and analyzed so as to be both faithful in meaning to the original source materials and in a form which is computer encodable [7]. The validity and acceptability of a decision or solution can be questioned if it differs from existing set and established legal framework. The justification for the outcome arises through the community's acceptance of conclusions [1], and the meaning of law must be interpreted in the light of many implicit and ever changing assumptions in the political and social context.

The contentions in the foregoing paragraphs, in a given environment, can be addressed if the processes are identified and their relationship accordingly modeled. The contributing actors and their roles in the processes identified can then be represented as agents.

Multi-agents offer a new paradigm for organizing AI applications [20]. A multi-agent system consisting of a number of agents interacting with each other have the ability to exchange messages through a computer network infrastructure [25], and has both internal and external communication.

The external interactions, therefore, can focus on the interaction with the processes in law making and its environment and advantage can be taken of the internal interactions to focus on the cooperation between the agents in the legislative drafting process, also forming part of the law making process; legislative drafting process being a sub-set of the law making process.

A major theme in multi-agent systems in a given task is the autonomy of the agents. Agents' autonomy can be ensured as follows [18]:

- a. The capability of each agent to determine whether or not itself is competent to solve a problem, (This is applicable where a given functionality has to operate independently in executing a drafting task); and
- b. The capability of each agent to integrate into a global solution for a problem the counsels given by other agents (This is pertinent where collective effort by the actors in the law making process is required for a drafting task).

According to Tian and Tianfield [23], multi-agent technology has been widely used in the development of complex systems. A multi agent system [22], in its approach to system development consists of four steps [25];

- a. Identification of the agent's role;
- b. Identification of the responsibilities and services of the role;

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- c. Determination of the goal and plan to achieve the goals; and
- d. Determination of the belief structure.

- Areas for overall cooperation should be modeled.
- Behavioral rules for individual agents and agent to agent interactions (no overlap in roles)

2.5 Proposed Relationship Model between the Legislative Process Actors

The model for this relationship takes a distributed approach, [9][10][11]; wherein the different actors have to work together to provide an appropriate legislative regime, taking care of the distribution of the data, distribution of control, distribution of expertise and distribution of resources required for this task. Consequently, the actors and their interactions can be mapped into autonomous problem solving agents with own resources and expertise. We note that this approach enhances cooperation over time though agents are autonomous and interactions are dictated by roles in the problem solving process at a given time.

The model takes cognizance of the different roles, characterizes the relationships that exist between these roles and how these roles can best be realized; and the agent architecture should be adopted for each role to deliver the functional and non-functional characteristics of each role [9].

The agent architecture [9][12] is a specification of a set of software and/or hardware components which together satisfy the properties specified by the agent theory. The architecture is in turn implemented in real hardware and/or software developed using languages which may directly embody principles of the theory or tools which provide direct support for the architecture.

It follows therefore, that both the law making and legislative drafting processes' actors need to interact in a problem solving task. The law making task aims at an enactment of legislation while the legislative drafting process aims at translating policy to a draft law/bill for passage into law by Parliament.

The modeling process therefore, seeks to address the following:-

- Each of the agents (actors) has a goal to achieve (goal-based agents).
- Each of the actors and roles in the legislative process is identified and represented by an agent.
- Interdependent problems to be addressed by cooperating agents and system to ensure that roles falling under this category are managed so as not to infringe on the doctrine of separation of powers.
- Independent problems likewise follow the same principles and the same must be treated as such.

3. PRESENTATION OF THE LEGISLATIVE PROCESS MODEL

Agent based systems, wherein the key abstraction used is that of an agent, may be conceptualized in terms of agents but implemented without any software structures corresponding to agents, however, to avoid counter-productivity, an agent system ought to be both designed and implemented in terms of agents [25], wherein it was further observed that that cognitive scientists have been developing agent languages that permit agents to communicate statements, requests and negotiate demands.

This study adopted the agent based modeling approach with the use of Net Logo programming language and environment. Net logo is compatible with Windows, MacOS X or Linux operating systems; and can run models illustrating different types of multi-agent systems.

The structure of the model incorporates four actors identified for purposes of modeling legislative drafting process (Draftsman/person) and the law making process actors (Executive, Legislature and Judiciary) as depicted in Figure 1 that follows.

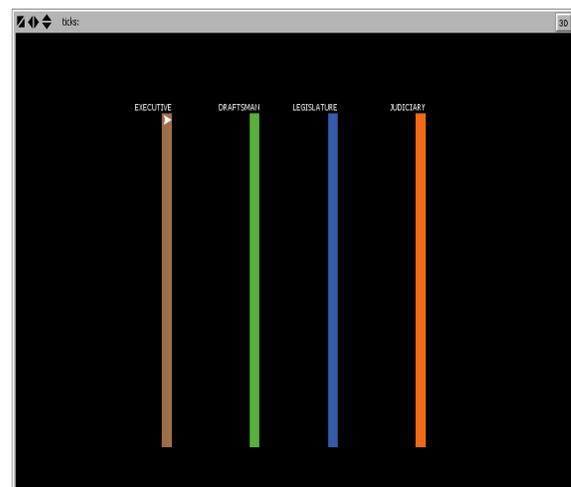


Fig 1: Structure of the Legislative Process Model

The two actors, the Executive and Draftsperson are key in the legislative drafting process, as depicted in Figure 2 below. Policy generated by the Executive is translated by the Draftsman/person into draft law, subject to queries in the form of matters for clarification and the draft bill is submitted for endorsement by the Executive, the Draftsman/person, having accomplished his/her role.

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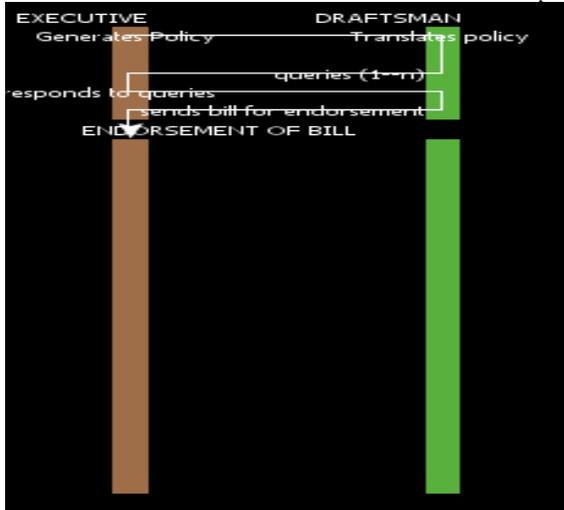


Fig 2: Relationship between the Executive and the Draftsman/person

The draft bill on endorsement by the Executive is submitted to the Legislature for debate and passage into law; and subject to queries and clarifications between the Executive and Draftsperson. Note that the Legislature can only relate with the Draftsperson through the Executive on drafting queries. See Figure 3 below.

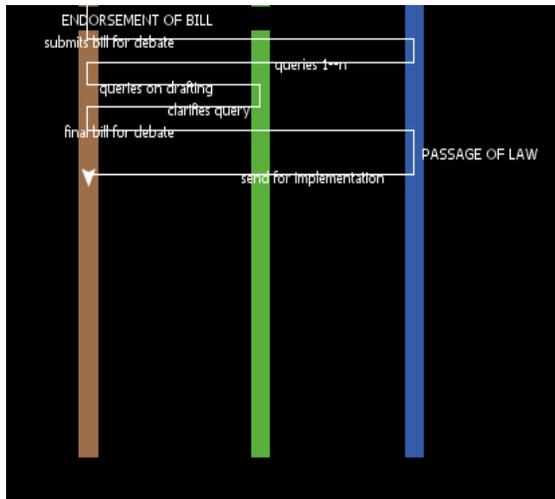


Fig 3: Relationship between the Executive and Legislature

The implementation phase, involving interpretation of the laws by the Judiciary, which is a post drafting stage may raise legal and/or constitutional issues, which are accommodated at the Executive stage, involving amendment of the laws or even enactment of new laws arising from court/interpretation process, as depicted in Figure 4 below.

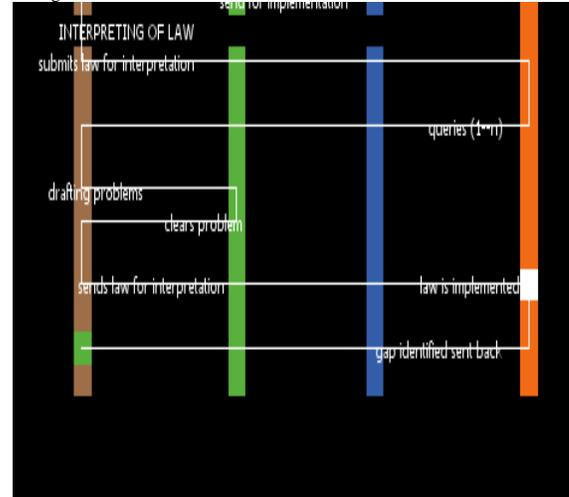


Fig 4: Relationship between the Judiciary and the Executive

The integrated legislative process model depicts the working relationship between the legislative drafting process and the law making actors. For each of the models for the various relationships, the process remains iterative until all the goals are achieved as set for the legislative process actors. See Figure 5 that follows.

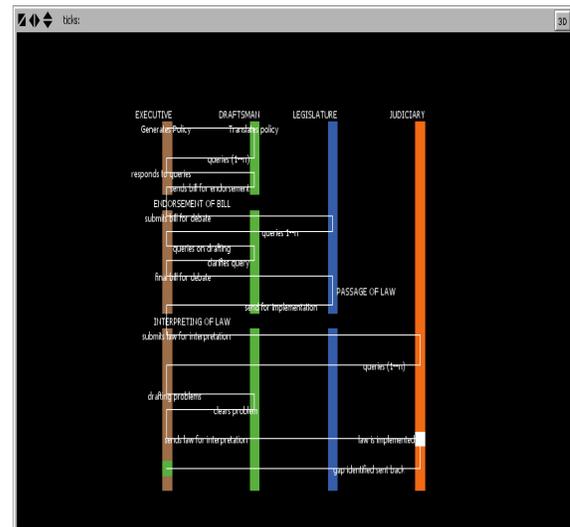


Fig 5: Integrated Legislative Process Model

4. DISCUSSION

The model, illustrated in Figure 5, guided by the doctrine of separation of powers was able to achieve the following:

- Each of the actors and their respective roles in the legislative process was identified and represented by an agent; and each of the actors, as goal-based agents, was able to achieve their goals. This was achieved by the use of the mobile agent – turtle, which easily

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illustrated the roles each of the agents played in the legislative process modeled.

- Interdependent problems to be addressed by cooperating agents (Executive and Draftsperson; Executive, Draftsperson and Legislature; Judiciary and Executive) were represented, and roles managed so as not to infringe on the doctrine of separation of powers.
- Behavioral rules for individual agents and agent to agent interactions without overlap in roles ensured independent tasks were handled by the respective actors/agents separately; while areas for overall cooperation were modeled.
- Both the legislative drafting process and the law making process and their relationship were visibly illustrated; and the distinct roles played by each of the actors, their interdependence and also their independence were achieved using this approach.

The modeling followed the principle that a given agent's output forms an input into another agent's in terms of roles with the Executive initiating the process. It therefore, follows that a failure in the initial processes contributes to a breakdown in the performance of the other agents. The problem solving process is therefore, that of collective approach and a failure in one agent may affect all.

However, a failure in the drafting process illustrated in Figure 2 may have an effect in Figure 3 and Figure 4; yet the reverse may not be true since process in Figure 2 is independent of the process in Figure 3; although its effort in contributing to tasks to be undertaken in Figure 4 will be futile.

Needless to mention, presentation of the different queries the process may go through leads to overcrowding and thus affects visibility of the process.

5. CONCLUSION

The application of the multi-agent system approach to modeling the relationship between the legislative and the law making agents, has made it feasible to model the relationship between the law making actors and legislative drafting actors without infringing on the principles enshrined in the doctrine of separation of powers. This approach captured the entire legislative process so as to accommodate the legislative drafting process pertinent in the law making process; not accommodated under the doctrine of separation of powers.

The practicability of use of the model has been made easy by Net Logo programming environment due to its interactive command window and can be a useful support tool in the legislative process, as discussed above.

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AUTHOR PROFILE



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Jennifer heads the Legal Department of the Electoral Commission of Uganda and is currently undertaking a PhD Research on the Application of Artificial Intelligence Systems in Legislative Drafting Practices in Uganda; and has recently published the following papers:

- "An artificial neural network model for regulating legislative drafting practices in Uganda" (ICCIR' 2010); and
- Evaluating the influence of environmental factors on legislative data using Support Vector Machine techniques" (ICCIR' 2012).

Ms Jennifer has participated in the following research projects:

- Part of a research team funded by Nuffic on Policy on ICTs in the 4 Universities of Uganda (ICTs for Persons with Disabilities and the Legal and Ethical Issues) (2004)
- Published a thesis entitled "A Dynamic Model for the Protection of Intellectual

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Property Rights in the Cyberspace''
(SREC'2005)

- Participated in Local Governance and ICTs Research Network for Africa (LOG-IN Africa) Project funded and supported by IDRC and CAFRAD on a Ugandan case study of ICTs and Local Governance. A Case Study of Local Government Information and Communication System (LoGICS) in Uganda (2006 – 2008)
- Part of a research team on a Case Study on Direct Democracy in Uganda funded by IDEA and published a Handbook on 'Direct Democracy in Uganda' (2007)

Dr. Peter Jehopio, is a Senior Lecturer in the School of Statistics and Planning and holds PhD in Applied Computing, Master of Education in Curriculum and Teaching, Master of Science in Software Technology for Computer Aided Engineering, in addition to Bachelor of Science in Statistics and Mathematics and a Postgraduate Diploma in Education. He is highly experienced in performing training needs assessment (TNA), participatory methodology of training, design of training modules, development of training/educational materials, assessment of training progress and evaluation of training program, design of information systems, etc. He has also been Lecturer, in various aspects of Education and Computer Science and their Applications in a number of universities in the United Kingdom and Uganda.

APPENDIX

SOURCE CODE

To setup

Let all-patches patches

Ask patches with [pxcor = -13 and pycor = 15] [set plabel "EXECUTIVE"]

ask patches with [pxcor = -4 and pycor = 15] [set plabel "DRAFTSMAN"]

ask patches with [pxcor = 4 and pycor = 15] [set plabel "LEGISLATURE"]

ask patches with [pxcor = 13 and pycor = 15] [set plabel "JUDICIARY"]

ask patches with [pxcor = -13 and pycor < 15 and pycor > -11] [set pcolor BROWN]

ask patches with [pxcor = -4 and pycor < 15 and pycor > -11] [set pcolor GREEN]

ask patches with [pxcor = 4 and pycor < 15 and pycor > -11] [set pcolor BLUE]

ask patches with [pxcor = 13 and pycor < 15 and pycor > -11] [set pcolor ORANGE]

create-turtles 1

ask turtles [set xcor -13, set ycor 14, set heading (90), set color white, set pen-mode "down"]

end

To simulate

print "simulating..."

ask turtles [;set pen-mode "down" if (pxcor = -13 and pycor = 14) [ask patches with [pxcor = -11 and pycor = 14] [set plabel "Generates Policy"]]

forward 1

if (pxcor = -4 and pycor = 14) [set heading 180, ask patches with [pxcor = -2 and pycor = 14] set plabel "Translates policy"]]

if (pxcor = -4 and pycor = 12) [set heading 270]

if (pxcor = -5 and pycor = 12) [set plabel "queries (1--n)"];

if (pxcor = -13 and pycor = 12, set heading 180)

if (pxcor = -13 and pycor = 11) [set heading 90]

if (pxcor = -11 and pycor = 11) [set plabel "responds to queries"]

if (pxcor = -4 and pycor = 11) [set heading 180]

if (pxcor = -4 and pycor = 10) [set heading 270]

if (pxcor = -5 and pycor = 10) [set plabel "sends bill for endorsement"]

if (pxcor = -13 and pycor = 10) [set heading 180]

if (pxcor = -13 and pycor = 9) [set pcolor black]

ask patches with [pxcor = -7 and pycor = 9] [set plabel "ENDORSEMENT OF BILL"]

ask patches with [pxcor = -4 and pycor = 9] [set pcolor black];

if (pxcor = -13 and pycor = 8) [set heading 90]

if (pxcor = -9 and pycor = 8) [set plabel "submits bill for debate"]

if (pxcor = 4 and pycor = 8) [set heading 180]

if (pxcor = 4 and pycor = 7) [set heading 270]

if (pxcor = 0 and pycor = 7) [set plabel "queries 1--n"]

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if (pxcor = -13 and pycor = 7 )[set heading 180]
if (pxcor = -13 and pycor = 6 )[set heading 90]
if (pxcor = -7 and pycor = 6 )[set plabel "queries on
drafting"];
if (pxcor = -4 and pycor = 6 )[set heading 180]
if (pxcor = -4 and pycor = 5 )[set heading 270]
if (pxcor = -5 and pycor = 5 )[set plabel "clarifies query"]
if (pxcor = 13 and pycor = 2 )[set heading 27]
if (pxcor = -13 and pycor = 2 )[set plabel " "];
if (pxcor = -13 and pycor = 5 )[set heading 180]
if (pxcor = -13 and pycor = 4 )[set heading 90]
if (pxcor = -9 and pycor = 4 )[set plabel "final bill for
debate"]
if (pxcor = 4 and pycor = 4 )[set heading 180]
if (pxcor = 4 and pycor = 3 )[ask patches with [pxcor = 10
and pycor = 3] [set plabel "PASSAGE OF LAW" ]
if (pxcor = 4 and pycor = 2 )[set heading 270]
if (pxcor = 2 and pycor = 2 )[set plabel " send for
implementation"]
if (pxcor = -13 and pycor = 2 )[set heading 180]
if (pxcor = -13 and pycor = 1 )[set pcolor 0]
ask patches with [pxcor = -7 and pycor = 1] [set plabel
"INTERPRETING OF LAW"]
ask patches with [pxcor = -4 and pycor = 1] [set pcolor
black]
ask patches with [pxcor = 4 and pycor = 1] [set pcolor
black]];
if (pxcor = -13 and pycor = 0 )[set heading 90]
if (pxcor = -7 and pycor = 0 )[set plabel "submits law for
interpretation"]
if (pxcor = 13 and pycor = 0 )[set heading 180]
if (pxcor = 13 and pycor = -2 )[set heading 270]
if (pxcor = 11 and pycor = -2 )[set plabel "queries (1--n)"]
if (pxcor = -13 and pycor = -2 )[set heading 180]
if (pxcor = -13 and pycor = -4 )[set heading 90]
if (pxcor = -10 and pycor = -4 )[set plabel "drafting
problems"]
if (pxcor = -4 and pycor = -4 )[set heading 180]
if (pxcor = -4 and pycor = -5 )[set heading 270]
if (pxcor = -4 and pycor = -5 )[set plabel "clears problem "];
if (pxcor = -13 and pycor = -5 )[set heading 180]
if (pxcor = -13 and pycor = -7 )[set heading 90]
if (pxcor = -5 and pycor = -7 )[set plabel "sends law for
interpretation "]
if (pxcor = 13 and pycor = -7 )[set heading 180, set pcolor
white
ask patches with [pxcor = 12 and pycor = -7] [set plabel
"law is implemented"]]
if (pxcor = 13 and pycor = -9 )[set heading 270]
ask patches with [pxcor = 11 and pycor = -9] [set
plabel "gaps identified are sent back"]]
if (pxcor = -13 and pycor = -9 )[set pcolor green]
ask turtles with [xcor = -13 and ycor = -9][die]]
; print "end of simulation"
;ask turtles with [xcor = 13 and ycor = -7][; die;]]
end
to restart
clear-all
end

```
