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Odessa National Academy of Food Technologies, 2021

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V. Conclusion

Given the advantages we have highlighted in favor of SSDs, in mid-range and high-end configurations, the presence of SSDs today is a must. It is unclear whether the SSD will completely replace traditional HDD, especially in increasingly accessible cloud space. SSDs are falling in price, but they are still too expensive to completely replace terabytes with data that some users have.

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COMPLEX SYSTEM OF AI INTERACTIONS IN SOCIAL SIMULATION OF A CITY INFRASTRUCTURE

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Abstract. *Goal of this project is the research and development of an artificial intelligence for city infrastructure and social interactions in simulator game for deeper immersion and analysis of mental states of players. It composes of complex interactions of mental states, personality traits, fields of activity of characters and events in which the characters may be involved. This system will bring the activity of AI closer to human. This opens up many possibilities for using this system, namely:*

1. For a deeper immersion and flow in the game world;

2. To analyze human actions in certain situations;

3. To analyze the mental state of the player during the game through his choices.

Keywords: *Artificial Intelligence, personality, social engineering, social interaction, mental state, psychology*

I. INTRODUCTION

Nowadays a great evolution of used technologies in game industry that continues to improve graphics and in-game mechanics shows that game development is important for modern society. Generations of gamers making a lot of various subcultures. These interests significantly influenced their perception and life in general, and, consequently, the life of future generations. This influence, which has been criticized many times for brutality, is not a strong argument in favor of critics because it is not the cause of an aggressive or depressed state of people.

This system can be a solution to this problem by assessing the player's gaming experience to check his psychological state. This process will require a thorough analysis of the player's choice in different situations. In addition, the difficulty of the assessment increases, as does its effectiveness, due to deep immersion in the gameplay. This immersion is provided by a complex system of character mental states and interactions with environment.

II. LITERATURE ANALYSIS

Efforts by cities around the world to engage artificial intelligence (AI) and robotics for their betterment aim generally to support or extend the “social infrastructure” of the city. Ideas about how the life of each city’s resident ought to be constituted, supported, and improved through AI and robotics technologies guide these activities. At the same time, the new visions of AI-and robotics-enhanced cities expose changing social values and norms that we must examine to understand how their enactment may affect urban life [5-8].

The meaning of “social infrastructure” can be categorized in three iterations. Traditionally, social infrastructure referred to the subset of infrastructure assets that accommodate social services, for example: medical facilities, schools, community and sport facilities, local government facilities, water treatment, bus stations, parks, prisons and court houses. The term itself is curious because it applies “social,” a term we usually associate with human interaction, to infrastructure, which is about physical organization as a means to provide a service. Thus, the services provided by social infrastructure (clean water, education, correction) in this original meaning of the word can be seen as material and institutional supports for a particular way of life. As social media companies became popular, the term “social infrastructure” took on a second and parallel meaning to describe internet services supporting integration of “social functionality” with their products and user interfaces [5-8].

Agent-based modelling and simulation (ABMS) is a relatively new approach to modelling complex systems composed of interacting, autonomous ‘agents’. Agents have behaviours, often described by simple rules, and interactions with other agents, which in turn influence their behaviours. By modelling agents individually, the full effects of the diversity that exists among agents in their attributes and behaviours can be observed as it gives rise to the behaviour of the system as a whole. By modelling systems from the ‘ground up’—agent-by-agent and interaction-by-interaction—self-organization can often be observed in such models. Patterns, structures, and behaviours emerge that were not explicitly programmed into the models, but arise through the agent interactions. The emphasis on modelling the heterogeneity of agents across a population and the emergence of self-organization are two of the distinguishing features of agent-based simulation as compared to other simulation techniques such as discrete-event simulation and system dynamics. Agent-based modelling offers a way to model social systems that are composed of agents who interact with and influence each other, learn from their experiences, and adapt their behaviours so they are better suited to their environment [5-8].

Agents may also have other useful characteristics [5-8]:

An agent may be adaptive, for example, by having rules or more abstract mechanisms that modify its behaviours. An agent may have the ability to learn and adapt its behaviours based on its accumulated experiences. Learning requires some form of memory. In addition to adaptation at the individual level, populations of agents may be adaptive through the process of selection, as individuals better suited to the environment proportionately increase in numbers.

An agent may be goal-directed, having goals to achieve (not necessarily objectives to maximize) with respect to its behaviours. This allows an agent to compare the outcome of its behaviours relative to its goals and adjust its responses and behaviours in future interactions.

Agents may be heterogeneous. Unlike particle simulation that considers relatively homogeneous particles, such as idealized gas particles, or molecular dynamics simulations that model individual molecules and their interactions, agent simulations often consider the full range of agent diversity across a population. Agent characteristics and behaviours may vary in their extent and sophistication, how much information is considered in the agent's decisions, the agent's internal models of the external world, the agent's view of the possible reactions of other agents in response to its actions, and the extent of memory of past events the agent retains and uses in making its decisions. Agents may also be endowed with different amounts of resources or accumulate different levels of resources as a result of agent interactions, further differentiating agents.

In an agent-based model, everything associated with an agent is either an agent attribute or an agent method that operates on the agent. Agent attributes can be static, not changeable during the simulation, or dynamic, changeable as the simulation progresses. For example, a static attribute is an agent's name; a dynamic attribute is an agent's memory of past interactions. Agent methods include behaviours, such as rules or more abstract representations such as neural networks, which link the agent's situation with its action or set of potential actions. An example is the method that an agent uses to identify its neighbours [5-8].

One tool that has been increasingly used to examine urban health issues is agent-based modeling (ABM). Agents are given traits and initial behavior rules that organize their actions and interactions. Stochasticity can be included in the assignment of agent characteristics and in determining which agents interact and how agents obtain information and make decisions. The model is run over time and repeated numerous times, to obtain a distribution of possible outcomes for the specified system. The micro-entities, referred to as "agents", are anything that alters its behavior in response to input from other agents and the environment [5-8].

ABM is able to accommodate high heterogeneity in agent characteristics and interactions between agents and environments, as well as features like dynamics, feedbacks and adaptation, which are impossible to represent in traditional statistical models. Agents can be defined at multiple levels, including individuals or group of individuals (e.g., families, institutions, policy-making bodies etc.). Research questions that require significant heterogeneity within and between agents and diverse spatial and relational elements are well-suited to ABM. In urban health research, simulations can be used to explore dynamic scenarios involving diverse entities and settings such as the built and social environment, city agencies, legislative bodies, health services, individual residents and families. Some agent-based models include detailed data and strive for high realism [4] while others are abstract [5-8].

Despite the ABM suitability to research complex problems in urban health, it is a new tool to many researchers. One important barrier to foster ABM adoption among researchers is their unfamiliarity with steps needed to carry out the modeling. Therefore, the purpose of this paper is to provide a very brief introductory guide to carrying out a simple agent-based model. We then use a previously constructed model to illustrate the steps one can take when building a simple model. This is only a brief guide; before starting a computational model, it is recommended that readers refer to comprehensive guides [5-8].

All basic processes of ecological populations involve decisions; when and where to move, when and what to eat, and whether to fight or flee. Yet decisions and the underlying principles of decision-making have been difficult to integrate into the classical population-level models of ecology. Certainly, there is a long history of modeling individuals' searching behavior, diet selection, or conflict dynamics within social interactions. When all the individuals are given certain simple rules to govern their decision-making processes, the resultant population–level models have yielded important generalizations and theory. But it is also recognized that such models do not represent the way real individuals decide on actions. Factors that influence a decision include the organism's environment with its dynamic rewards and risks, the complex internal state of the organism, and its imperfect knowledge of the environment. In the case of animals, it may also involve complex social factors, and experience and learning, which vary among individuals. The way that all factors are weighed and processed to lead to decisions is a major area of behavioral theory [5-8].

While classic population-level modeling is limited in its ability to integrate decision-making in its actual complexity, the development of individual- or agent-based models (IBM/ABMs) (we use ABM throughout to designate both "agent-based modeling" and an "agent-based model") has opened the possibility of describing the way that decisions are made, and their effects, in minute detail. Over the years, these models have increased in size and complexity. Current ABMs can simulate thousands of individuals in realistic environments, and with highly detailed internal physiology, perception and ability to process the perceptions and make decisions based on those and their internal states. The implementation of decision-making in ABMs ranges from fairly simple to highly complex; the process of an individual deciding on an action can occur through the use of logical and simple (if-then) rules to more sophisticated neural networks and genetic algorithms. The purpose of this paper is to give an overview of the ways in which decisions are integrated into a variety of ABMs and to give a prospectus on the future of modeling of decisions in ABMs [5-8].

III. OBJECT, SUBJECT, AND METHODS OF RESEARCH

Complex AI system

Research into the possibilities of artificial intelligence in the gaming industry is yielding amazing results. The search for better action through a comprehensive set of tools and the freedom of AI comes to "creative" solutions. It also allows a player to feel deeper immersion, flow and presence with a human-like NPC intelligence and complex system of interactions. Applying this system of complex interactions to a city infrastructure simulator, we get random interactions of characters with / without the participation of a player, which in one way or another affect the world, and therefore the player himself.

Structure of complex interactions system

First of all, in this system, it is worth developing a scheme of social interactions between the fields of activity of the city infrastructure and the properties of the corresponding type of activity that are characteristic of them (Fig. 1).

Fields of activity, like characters in this system, have a number of characteristics, such as:

– Dependence (on other fields of activity);
– Recruitment capability;
– Necessary staffing requirements;
– Possibility and ways of interacting with other fields of activity;
– Reasons and methods of staff reduction (complicate due to the personal qualities of the characters and the player);
– Ways and opportunities for career growth;
– The ability to change the field of activity;
– The level of conflict between fields of activity;
– Influence on other fields of activity;
– Influence on subordinates during career growth in their field of activity.

All these characteristics of fields of activity are independent but can influence each other through complex interactions between characters, taking into account their personality traits.

In addition to fields of activity, actions themselves also have characteristics, such as:

– The number of characters participating in the action for each field of activity;
– Possibility of interaction between fields of activity;

- The ability to perform new actions based on this action;
- The ability to perform new actions based on several actions interconnected through complex interactions between characters according to their personality traits;
- The possibility of random participation of characters that have no connection with the fields of activity performing the action;
- The ability to influence other fields of activity through action;
- The ability to change the level of conflict between fields of activity;
- The ability of participating characters to change the field of activity;
- Career opportunities for characters involved in the action.
- Location of the action;
- The ability to change the level of conflict between characters according to their personal traits.

The location of the action isn't less important and also has a number of characteristics, such as:

- Open or closed space (introduces a number of restrictions on the actions of characters and can influence their decisions);
- Location belonging to the field of activity;
- Possibility of better or worse interaction of fields of activity;
- The ability to interact with characters from conflicting fields of activity due to personal traits;
- Possibility of a random event due to environmental elements or/and personal traits of characters;
- The possibility of action;
- Ability to change the level of conflict between fields of activity.
- Ability to change the level of conflict between characters and player;
- Content of sublocations with their own set of characteristics out of all possible.

All this system creates an opportunity of wide range of complex activities between fields and involved characters, making immersion deeper.

The personal traits and mental state of the characters is the main factor in the choice of subsequent actions of the characters.

A complex set of character characteristics allows to most accurately convey human-like AI interaction with other characters and player in different actions with fields of activity at locations or sublocations.

Personal character traits and his state of mind as a whole constitute a large decision-making system, taking into account the number of factors, such as:

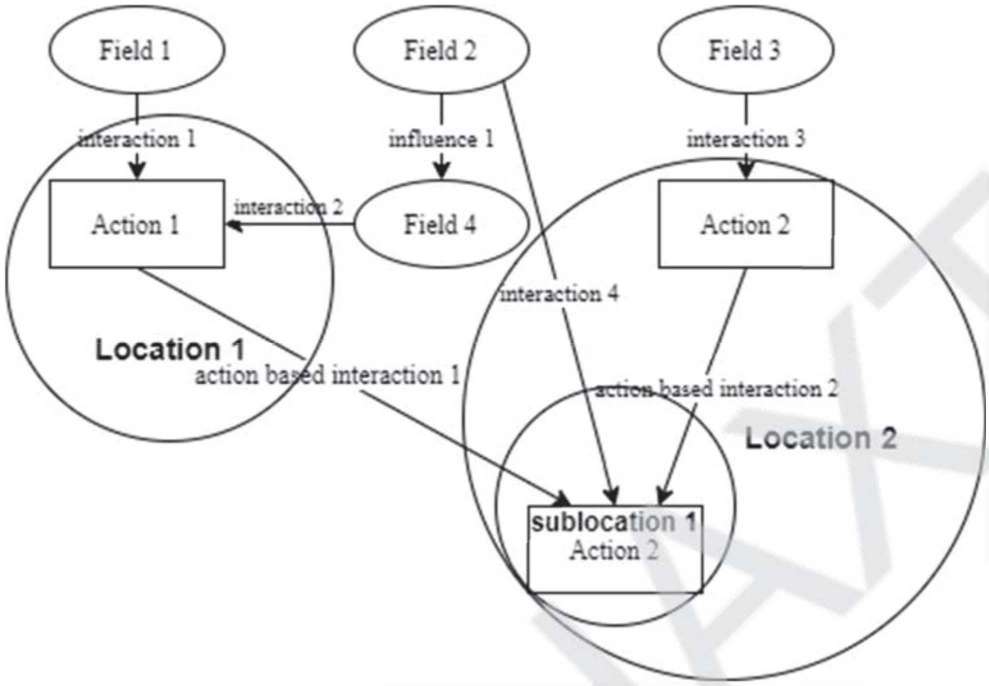

Figure 1. Basic interactions between fields of activities and actions at the certain locations (without influence of personal traits of characters)

– Temperament (sanguine, choleric, phlegmatic, melancholic);

These types of temperament have a difference of interaction between each other.

– Character (contains 4 groups of traits expressing the attitude to different aspects of life: attitude to work; attitude towards other characters; attitude towards oneself; attitude to things);

Each of group has a positive and negative trait types.

– Abilities (to do something);

– Emotions (preferences and fears);

Abilities and emotions can depend on the environment and physical, mental state, which can change in the course of action and are interrelated.

– Personality orientation (The focus is on the task, on communication, on oneself);

– The ability to adapt and accommodate (the ability to change personal traits later on participating in activities);

– Moods (the ability to change the mood after the actions taken);

– Self-assessment (attitude towards oneself, assessment of one's abilities);

– Ability to generate ideas (from the list of possible, taking into account the field of activity and nature) and search for possible performers;

In accordance with this system of interaction of characters with all the influence of the environment, the player, through his choice, will compose his psychological portrait, according to which it is possible to diagnose the player with psychological problems.

IV. RESULTS

Due to this work a complex system of city infrastructure interaction has generally been developed up to the personal characteristics of the characters, namely:

– Interactions between fields of activity through actions in certain locations, taking into account complex interactions between characters;

– Actions and their characteristics, possible consequences affecting the fields of activity (including their members individually) and locations;

– Locations that can influence the relationship between fields of activity through the actions that take place and the possible environment;

– A complex set of characteristics that, through the individuality of each character, influences the decisions made and the state of affairs in the game world;

– An analysis of concepts such as immersion in the game world, flow state and a sense of presence, which include physical and emotional immersion in the game, loss of self-awareness and constant attention;

– The concepts of Personality and behavior;

– Analysis of AI in video games.

V. CONCLUSIONS

This system of interactions creates wide range of possibilities in video game industry to provide great idea of immersive game world and helping people with psychological problems to prevent irreversible.

With all the possible actions that can happen in the game, according to the player's choice, building a psychological portrait does not cause problems. According to research by psychologists, playful tests allow you to make a choice sincerely, without hesitation. It is impossible to obtain a psychological state in an absolutely exact measure. It is possible to get only a snapshot of the current state of consciousness and subconsciousness. But you can understand some controversial points worth paying attention to and taking them into account in the future.

I will develop this system in more detail to get more immersion in the gameplay and for a more accurate analysis of the psychological state of the player.

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SYSTEM OF AUTOMATED DETECTION OF CERAMIC DISC SURFACE DEFECTS

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Abstract. *A handheld USB digital microscope is considered as an instrument for ceramic disk inspection automatization in the production cycle. It provides the opportunity for surface defect detection in the needed range from 50 to 500 µm. Such a device providing 15 fps with the standard VGA resolution of 640x480 pixels enables one track scan for 18 seconds. As a decision unit, a system based on the artificial neural network was used. The basic system software has been developed. A study of the object illumination and the size of the database influence on artificial neural network training results (probability of defect detection) have been carried out. The use of digital filtration, adaptive histogram equalization, threshold function, and feature detection as a classical approach showed a good result. Deep learning has proven its effectiveness, selecting features of the defect and presenting more stable results in defect detection.*

Keywords: *artificial neural network, image recognition system, digital microscope, ceramic discs.*

I. INTRODUCTION

Technical ceramic parts have increased use in textile machinery. For example, ceramic discs used for texturing yarns as guide discs, working discs, and knife discs. Ceramic components offer significant performance enhancement in textile machinery due to optimized grip and eliminated snow, as a result of special surface engineered features.

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