Chapter 31
Development of Digital Game Environments Stimulating Creativity in Engineering Education

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ABSTRACT

Teaching for creativity is one of the most challenging problems in engineering education. Two approaches are mostly applied in teaching creative skills: using creative problem-solving exercises and emerging people into a creative environment for stimulating their creativity. One of the most important requirements to creative digital environment is creativity of its non-player characters (NPC). The chapter discusses the advantages of applying a multi-agent (MA) approach to achieve creative behavior of the NPCs. The agent architecture is based on a behavior tree model, extended with three additional classes of nodes, implementing agent reactions and adaptive action planning according to agent priorities. The proposed agent architecture is implemented in a typical survival action game where all players, represented as agents, should explore the world to find resources. The assessment of the quality of agents' behavior shows that all the agents successfully demonstrate rational and adaptive behavior in the complex dynamical environment.

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INTRODUCTION

Over the past two decades, creativity in learning has been recognized to be increasingly significant as a skill to be covered in formal education. Many researchers agree that the main purpose of education is to train not only professional skills, but also creative thinking. In engineering education, creativity is one of the most important skills (Sauthwik, 2013), (Hadzigeorgiou, Fokialis, & Kabouropoulou, 2012). Engineers have not only to recognize, validate, and solve problems on their own or through team work, but they should demonstrate original and critical thinking, and creativeness and innovativeness in their methodologies (Baillie, 2002). Engineers need a creative mind to meet the advancing goal of the engineering profession to design new products or systems and improve existing ones for the benefit of humankind (Shaw, 2001).

Some people argue that creativity cannot be taught at all as it is a natural capacity of certain people. But many people believe that creativity is a skill that can be developed and a process that can be managed (Shabalina, Mozelius, Vorobkalov, Malliarakis, & Tomos, 2015), (Maher, Merrick, & Saunders, 2008).

Two general approaches are mostly applied in teaching creative skills: using creative problem-solving exercises and placing people into a creative environment for stimulating their creativity.

The first approach is based on sharing creative experience among the people. A lot of problem-solving activities and exercises have been developed by people possessing strong creative thinking that can be used for training creative skills. It is assumed that if one can solve those problems he expands his knowledge and thinking capabilities. The most obvious limitation to this approach is its strong dependence on the exercises being used for training.

The second approach provides much more freedom for developing creative thinking as it is not limited to certain tasks and activities. Getting involved in a creative environment encourages people to correspond to this environment, i.e. to be creative himself, but without offering them any possible problem solutions. This approach is much more creative per se.

Digital games can provide the most effective environments for training creative skills. It is possible that games (at least the good games) stimulate creativity and a game player must be creative in order to be successful. Educational games can also develop creative skills if the learning process is organized in the same way as a game process and the game provides a truly creative game environment.

In the following, we describe the development of a particular component of potential educational environments of the future that would be intended to help develop student creativity. That is, we plan to develop more capable kinds of AI agent. Any rich environment will need other characters to interact with, and if they need to act in a controlled way in order to produce some desired effect in the users, then they should be artificial characters. In video games, these are called NPCs (non-player characters). Video games often do include NPCs but they are designed to act as enemies or simple allies in some larger story. They are often predictable, within limits: both to give the player a more predictable experience, but also because it is easier to program them that way, for some designed role. Game developers do often experiment with new ways to make NPCs more believable, to give a more authentic experience; but this will often mean that they behave more erratically, which can disrupt the player experience.

Background: Principles of Creative Digital Environment Design

One of the most important features of creative environment is creativity of its habitats. With regard to digital games this means creativity of non-player characters (NPC).