THE GORGE APPROACH
Digital Game Control and Play for Playfully Developing Technology Competence

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Abstract: Playful learning is an old dream of mankind since Comenius' early work on didactics (Comenius, 1628). But playful learning should not be oversimplified and thoughtlessly identified with effortless fun. In contrast, playful learning may be some fun, although being demanding requiring concentration, devotion and stamina. GORGE is the name of a digital game designed for the purpose of developing certain technology competence. It is in use with students of an age ranging from about 12 to 24. This poster surveys the concepts and the game.

Was wir über unsere Gesellschaft,
ja über die Welt, in der wir leben, wissen,
wissen wir durch die Massenmedien.

[Niklas Luhmann, 08.12.1927– 06.11.1998]

1 INTRODUCTION

"What we know about our society, about the world in which we live, we know it through the mass media." (see (Luhmann, 1996), original text in German above)

We surely know much from our parents, much from school, much from our peer group, but there is a large field of knowledge, indeed, which we gain through the consumption of mass media. In earlier days, there were press, radio and TV, nowadays there is the Internet, in addition. Motion picture and digital games are another relevant source of knowledge.

How and where from do children and young adults gain technology competence? How does technology competence evolve? How much are we in control of the process of technology competence emergence? In particular, what do children and adolescent persons know about the reach and the limits of information and communication technologies (IT), in general? And more specifically, what do they know about the power and the limitations of Artificial Intelligence? Where does this knowledge, where are our fears and our expectations coming from?

To a certain generation, Stanley Kubrick's film "2001: A SPACE ODYSSEE", 1968, might be a key source of fear when pondering the future of Artificial Intelligence (AI) applications. To a later generation, the TV series "CSI" might be a source of worrying belief in the power of technologies able to serve as a substitute of human skills and thought.

Technology competence has its foundations in other disciplines such as mathematics, e.g. There is no doubt that a good school education is fundamental to technology competence.

But school would be easily overtaxed if we were giving all responsibility for the development of technology competence to school.

The present poster publication asks for alternative approaches complementing the efforts of parents and school in the development of technology competence of children and adolescent persons. Insights into the importance of play and exploration (Power, 2000) are driving the research, implementation, and application.

Play as exploratory learning is a well-established issue of research, development, and–more or less successful–applications for already several decades (Reilly, 1974). Nevertheless, if you are addressing specific questions in detail, they often remain open.

What does the term "machine intelligence" mean? How does it work that a computer appears intelligent? Can we program machines in a way to–apparently–show emotions? Are there problems to worry about?

2 THE RESEARCH GOAL

At the end of the preceding section, the author has exemplified a few questions of technology competence

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focusing the admittedly narrow field of perceiving and understanding a certain feature of IT systems: AI.

A more comprehensive catalogue of problems and related questions is beyond the limit of the present short paper which, instead, aims at a poster providing a visually appealing introduction of the game idea, an illustration of the existing game implementation, and a discussion of the game's application for exploratory learning. Before going into details, we need to clarify the ultimate goal of the present work.

There is a first rather general research question:

> Given a rather clearly defined area of technology and a related catalogue of questions about the perception and understanding of this technology, how to design a digital game helpful to gain technology competence in this area through exploratory learning?

Because there is not much hope for general answers to rather general questions, we are going to attack a sufficiently attractive instance of the question above:

> How to design and implement a digital game as simple as possible which supports players in understanding of and becoming familiar with some essentials of AI such as those listed below?
>
> - Control of IT systems behavior to appear anticipatedly intelligent
> - Effects of AI in complex systems
> - Evaluation of AI behavior w.r.t. efficiency, believability, and effectiveness
> - Feeling of being able to master AI

To reach these goals, there has to be designed and developed a game

- which substantially depends on AI components,
- in which the role of AI becomes obvious,
- in which players have the option to control AI,
- in which varying behavior of AI components is essential to the game playing experience,
- and which is easy enough to be studied in detail by students of a wide range of ages.

The present research goals are achieved by means of the digital game GORGE to be introduced in the three subsequent sections. Only a few first steps of a qualitative evaluation–going beyond the limits of the present poster presentation–are discussed in the closing section before a summary concludes the paper.

3 REQUIREMENT SPECIFICATION

The digital game to be designed and implemented shall meet the following conditions:

1. The game must be simple in the sense that any particular game state may be easily described.
2. Game play must be sufficiently short to allow for larger series of experiements.
3. Non-player characters (NPCs) must have an easily tunable AI control.
4. The effects of different NPC AIs must be obvious.
5. Human players must have alternative choices of the way in which they engage with NPCs.
6. Despite the clarity of all the requirements above, mechanistic determinism of play must be avoided.

Under these conditions, one may set up largely varying series of experiments in which students play the game, experiment with varying variants of NPC intelligence and perform exploratory studies.

4 THE GAME IDEA

The author has developed some earlier game named JOSTLE (Jantke, 2007) designed for the purpose of studying particular behavioral patterns that show in game playing (Jantke, 2006).

The JOSTLE idea has been slightly generalized to a game concept named GORGE as follows:

- Players control a team of agents which have to move along alternative paths to reach a certain goal area for scoring points.
- Agents that meet on their way have opportunities of jostling each other to gain advantage over their adversaries.
- The paths are interrupted by gorges. No agent can pass a gorge when left to his own devices.
- Any two agents may form a roped party. A member of a roped party may step down into the gorge to allow the other one to pass the gorge.
- An agent passing a gorge decides about whether to rescue the other agent from the gorge or to leave him behind.
- The player's choices depend on some random variable, but are largely left to his own decision.

The game shall be playable among humans and NPCs. Whether or not some player is human may be hidden.

These ideas have been successfully implemented and tested with players of an age from 13 to 18.

5 EXPLORATORY LEARNING WITH THE GAME 'GORGE'

When the digital game GORGE is used for educational purposes, players should first get an opportunity to become familiar with the game and with the look and feel of NPC intelligence.

Next, the players must be introduced into the easy opportunities they have to set up and control AI.

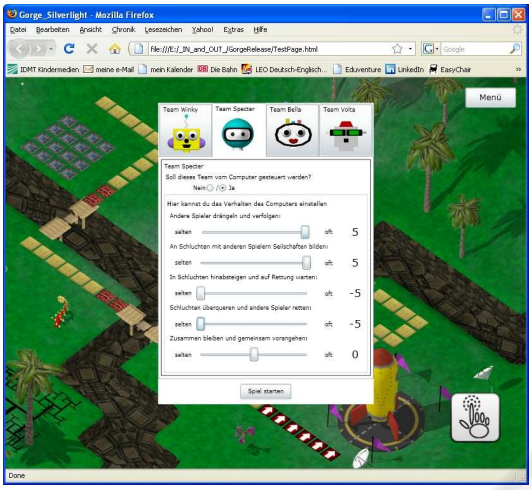

Figure 1: For every AI adversary, characteristics may be set.

There are sliders (see figure 1) simply allowing the player to determine the NPC's preferences whether or not to jostle, whether or not to engage in roped parties, whether or not to climb down into gorges, and so on. The adjustment shown in figure 1 determines a rather aggressive and uncooperative NPC behavior.

When players learn about the characteristics of NPCs, they are able to play with them and, even more ambitiously (and really funny!), to fool them. How to do so? For illustration, when NPC players have been identified to be aggressively interested in jostling, a human player may fool them by attracting them to struggling where they waste their time and give space to the player to unfold her strategy unmolestedly.

In the game case under investigation, the human player is commanding the team with white bodies.

In the game state on display in figure 2, a member of the white team turned right at the first branch of the path. Aggressive players are lured into following, because they are aiming at opportunities to jostle.

As a result, agressive players are preferring this path. They find opportunities galore to jostle each other. Meanwhile, the human player finds a separate way (see figure 3 above) where not much struggling is ongoing.

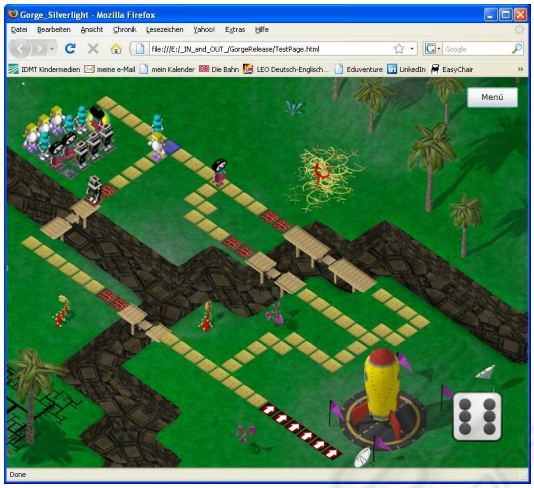

Figure 2: It is a big fun to play with and fool an NPC's AI.

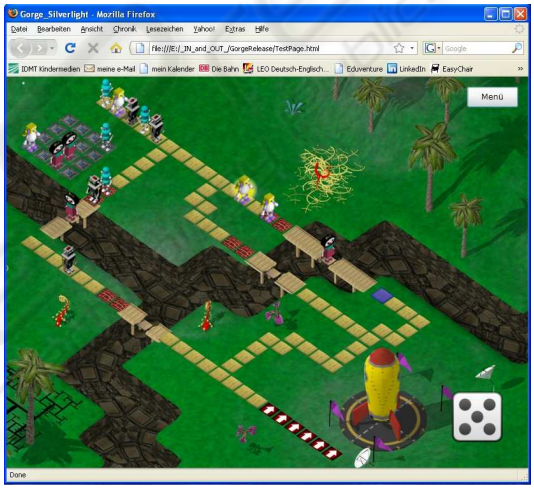

Figure 3: Attentive players draw benefit from observations.

Let us describe what is happening during game play from a viewpoint of playful exploration.

- Attentive players identify different behaviors.
- Understanding the NPCs' AI leads to tactics.
- NPC AI under control may be related to fun.
- It becomes obvious how intentional game settings contribute to game playing experience.
- Attentive players experience the pleasure and the satisfaction of superiority over programmed AI.

Naturally, it depends a lot on the individual human player, on her experience and her interest in game playing, on other preconditions, and on several contextual conditions such as, e.g., the current mood, how (s)he is experiencing the game play and how much (s)he is drawing advantage from insights into the other (computerized) players' behavior.

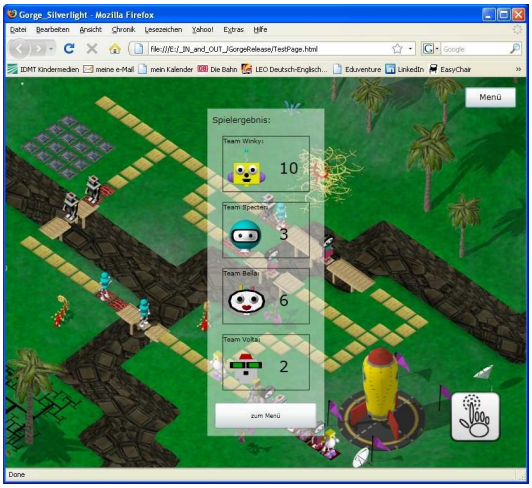

Figure 4: The human player's team scores 10 of 21 points.

The game reported throughout the present section has been ending with the human player's–in fact, the author's–victory (gaining 10 points out of 21 in total; see figure 4) demonstrating the tactic's success.

An a posteriori analysis of the game play–a key didactic form of exploratory learning with digital games–is usually very instructive. Players may learn how the NPCs' "implemented intelligence" unfolds. This is leading to insights into the way in which AI works, how it contributes to the experienced effects, and how much it depends on further conditions.

The next key didactic form is in-depth exploration. Learners have to set up experimental scenarios for investigating the effects of tuning an NPCs' AI. They are no longer only learners, but are becoming researchers elaborating own scientific hypotheses and pondering adequate methodologies of investigations.

6 SKETCH OF THE ACHIEVEMENTS

To invoke computers, in general (DiSessa et al., 1995), and games, in particular (Reilly, 1974), is not new to the community. But GORGE's (i) focus on technology competence and (ii) the opportunities to properly control proper AI system behavior in a playful setting are–to the author's very best knowledge–novelties in technology enhanced learning.

Players who have experienced GORGE do no longer consider Artificial Intelligence a mystery.

A separate study (see (Gaudl et al., 2009), for more details) has demonstrated that the AI in GORGE is expressive enough such that tuning "the character" of NPCs results in experiencing quite different stories.

7 SUMMARY & CONCLUSIONS

The game GORGE introduced by means of the present poster paper is a contribution to technology enhanced learning, in general. More specifically, GORGE may be seen as a "serious game" and the author's approach may be seen as a case of game based learning. The underlying didactical concept is exploratory learning.

GORGE is used for dealing with extra-curricularly topics such as technology competence with a focus to the attractive, but often misunderstood field of AI.

Whereas the present submission concentrates on motivating the game and its design, implementation, and functionality, future work should address issues of application, players' perception and evaluation.

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