Unraveling the Tales of Aurora - An Imaginative Serious Games Approach

J. Wagner [iD] , S. Winter [iD] and W. Höhl [iD]

School of Computation, Information and Technology (CIT), Technical University of Munich, Germany

Abstract

This demo paper develops a game concept titled "Tales of Aurora". This serious strategy game introduces the concept of chemical elements and compounds, biological processes and comprehensive life-cycle dependencies to a younger audience. Instead of high-level real-life knowledge we focussed on gaming fun, magic and imagination. This game incorporates a unique crafting system that teaches chemical compounds. Four basic elements are represented by seven imaginative plants. We enhance player identification, motivation and engagement by introducing an evolving animal companion named "Aurora". "Aurora" has the ability to transform based on consumed compounds. The game is divided into two phases. By day the player cultivates and places specific plants. At night the farm gets attacked by increasingly stronger enemies. The game therefore implements a counter-based combat system that requires players to apply their learned knowledge effectively, further captivating and engaging them throughout the learning experience.

CCS Concepts

• Human-centered computing → Interaction design; Interaction design process and methods; User centered design;

1. Introduction

The aim of this scientific paper is to show how gaming fun and imagination can be effective in teaching players about chemical elements and compounds, biological processes and comprehensive life-cycle dependencies. Many of related serious games such as "Elementary" or "Foldit" start at a fairly high level. We deliberately wanted to appeal to a younger target group from 6-9 years of age. Therefore the graphics, gaming fun, magic and imagination of the game should be adapted to these younger group of players.

1.1. Related Work

"Elementary" [Bra19] tries to convey real-life knowledge about the chemical elements. The goal of this game is to collect all 118 chemical elements. "Foldit" [KFH*19] is a protein folding computer game. Everyone can contribute playing this serious game to advance research on human health, bioengineering and biology. While players can discover all elements, their sources, usages, materials and ores in "Elementary", "Foldit" pursues a very sophisticated and high-leveled citizen science approach.

Our first idea was to adapt the resource management aspects of "Slime Ranchers" [Mor22], where the player collects various "Slimes". In order to advance in the game, players must breed variations of "Slimes" to obtain rarer items. The second idea was to combine the farming aspect from games like "Stardew Valley" [Doo22],

where the player has to take care of a plot of cultivated land over a series of recurring days. Finally we referred to the aspect of tower defense from "Plants vs. Zombies" [Don09], where the players strategically guard their home from invading enemies.

2. Prototype Development

This game concept incorporates various in-game mechanics, such as strategic planning, farming, crafting, and combat, to engage players in a intuitive learning experience. Combining these aspects, we settled on an engaging game, where the players have to cultivate and tactically place plants and manage an animal to defend their farm. At night time, the farm becomes the target of progressively stronger enemies. Defeating these, yields items enabling the player to craft new combinations of seeds and therefore progress in the game. Combinations of these seeds are based on four basic chemical elements, such as hydrogen, oxygen, carbon and chlorine.

2.1. Crafting and Compound System

The crafting and compound system offers a magic crafting book, that enables the player to combine the four basic chemical elements into three compound plants - water, fire and poison. Therefore the player can place two plant seeds representing the elements into the crafting book. By pressing the crafting button, these are magically combined to the according compound.
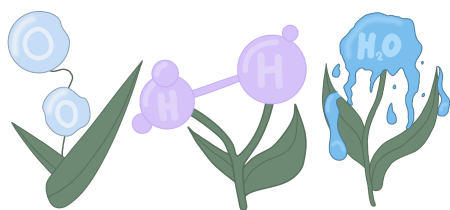
Figure 1: *Hydrogen, oxygen and water plant.*

The hydrogen plant is represented as a diatomic molecule. The two buds represent the two hydrogen atoms. Both are connected to each other by a thick bond. In the plants animation this is resembled through the buds not moving far from each other.

For example hydrogen and oxygen can be joined to gain a water seed compound. The water plant is designed to look very fluid and is animated to simulate wetness and dripping water droplets. Combined plants are stronger in combat and possess special abilities. This approach tries to teach the player about the elements the compounds consist of and further introduces the topic of chemical formulas.

As an identification figure for the player, we introduced a deer named "Aurora" as an additional feature into the game concept. By feeding the deer with compound plants, it undergoes a transformation into a unique life form. This emphasizes the significance of compound plants in contrast to the elemental plants and serves as additional motivation for players.

Figure 2: *Aurora can transform into a magical water deer.*

2.2. Level Design and Progression

The game levels are represented by weeks. At the end of each week the player faces a special boss enemy. To defeat these threats, it is necessary, to craft special chemical compound plants. For example in the first week the farm is attacked by the boss of type fire. The player learns about the special compound plant water, which opposes the enemy by countering traits.

Each week gives the players a certain amount of preparation time to build up their defenses. The initial phase involves the aspects of farming and crafting. During this phase, the player prepares for impending attacks by cultivating and strategically placing plants and taking care of "Aurora". In the second phase at night, the player is able to steer "Aurora" to support the preplaced plants in protecting

Figure 3: *The Game User Interface.*

from incoming enemy waves. Each plant attacks the invading enemies automatically. Every one has a projectile which is inspired by the chemical markup. The water plant, for example, shoots a water ray that is most effective against fire enemies.

3. Conclusion

Integrating gaming fun with imaginative elements has proven to be an interesting approach to innovative learning methods to us. To enhance our game concept, we intend to develop a storyline that introduces a suitable grown antagonist to the deer "Aurora". This supplement serves as an additional source of motivation for the players to engage with the game and deepen their understanding of chemical and biological concepts. Furthermore, we intend to implement a collection feature that allows players to save discovered elements and compounds into a dynamic period table. As our approach incorporates imaginative design choices, it would also be interesting to explore the effectiveness of a knowledge-based and scientific approach for comparison and evaluation purposes.

Acknowledgements

References

[Bra19] BRAUN B.: *Elementary - Serious Game for Discovery of Chemical Elements.* Master's thesis, Department of Informatics: Games Engineering, Technische Universität München (TUM), October 2019. 1

[Don09] DONLAN C.: The friday game: Plants vs zombies. *Memento* (September 2009). EDGE - The Global Game Industry Network. 1

[Doo22] DOOLAN L.: Chucklefish hands over final stardew valley publishing responsibilities to creator. *nintendolife* (March 2022). 1

[KFH*19] KOEPNICK B., FLATTEN J., HUSAIN T., FORD A., SILVA D.-A., BICK M. J., BAUER A., LIU G., ISHIDA Y., BOYKOV A., ET AL.: De novo protein design by citizen scientists. *Nature 570*, 7761 (2019), 390–394. 1

[Mor22] MORROW EMELY, GEALOGO DAVID: Slime Rancher 2 release date, early access details, and more. *Dot Esports* (Septemeber 2022). 1