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AQUA REPUBLICA – HUMANISING WATER AND ENVIRONMENT EDUCATION AS WELL AS STAKEHOLDER ENGAGEMENT WITH SERIOUS GAMING

BY CHENGZI CHEW & GARETH JAMES LLOYD

DHI, UN Environment and UNEP-DHI Partnership have been developing and using online games since 2013, working to engage and educate stakeholders through a serious gaming initiative called Aqua Republica. During this time we have worked with many types of organisations using different versions of the Aqua Republica in a range of settings including government strategy workshops, national competitions and stakeholder engagement workshops.

Serious Games?

There is a big difference between what motivates people and what does not. While all have their own personal preferences, some activities can generally be considered much more exciting or interesting than others. A specific example of this is found in schools, where students are typically more stimulated by activities that they consider to be informal and fun, and often less so with more formal activities and materials (after Stapleton, A J, 2003; Shute, V. J., Ventura, M., Bauer, M. I., & Zapata-Rivera, D., 2009). Unfortunately, it is the more formal stuff that is usually considered to be of greater academic importance.

A serious gaming approach combines a learning objective in a fun activity, in order to increase the potential for learning uptake. Such an approach is of course not new and has a long history of application in everything from the songs children learn, to various work-related teambuilding events that they may have been subjected to over the years when they were growing up. Perhaps one of the best-known applications of an electronic-based serious “game” is that of flight simulators used in pilot training. One of the main reasons for the success of this kind of application is the recognised fact that pilots need a very realistic learning environment, but also one that is low risk and allows them to make non-catastrophic mistakes that they can learn from.

This learning by playing approach is commonly termed as “meaningful play” and a well-designed serious game environment provides a feedback mechanism that allows the player to



Figure 1: Testing out gameplay with a board game version of Aqua Republica

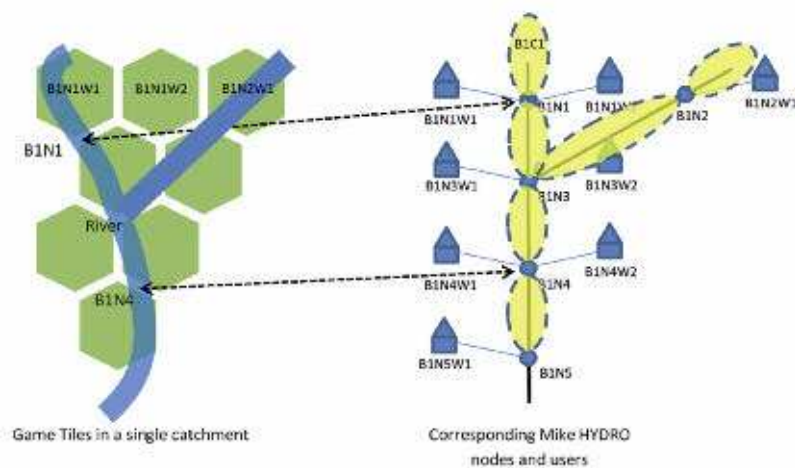


Figure 2. Schematic representation of how the Aqua Republica game connects to the MIKE HYDRO BASIN model

reflect on his or her actions and adopt different approaches or strategies. The internalisation of actions and reactions stimulates learning, often resulting in an increase in self-learning and knowledge retention.

Our professional passion lies in the field of water and environment, and one of our shared

non-work passions is in playing a wide variety of online games, as well as traditional board games. When we first started out on the pathway that led to Aqua Republica our ambition was to try to combine these interests in a way that would help people better appreciate the critical connections between water, social and economic development, and environmental

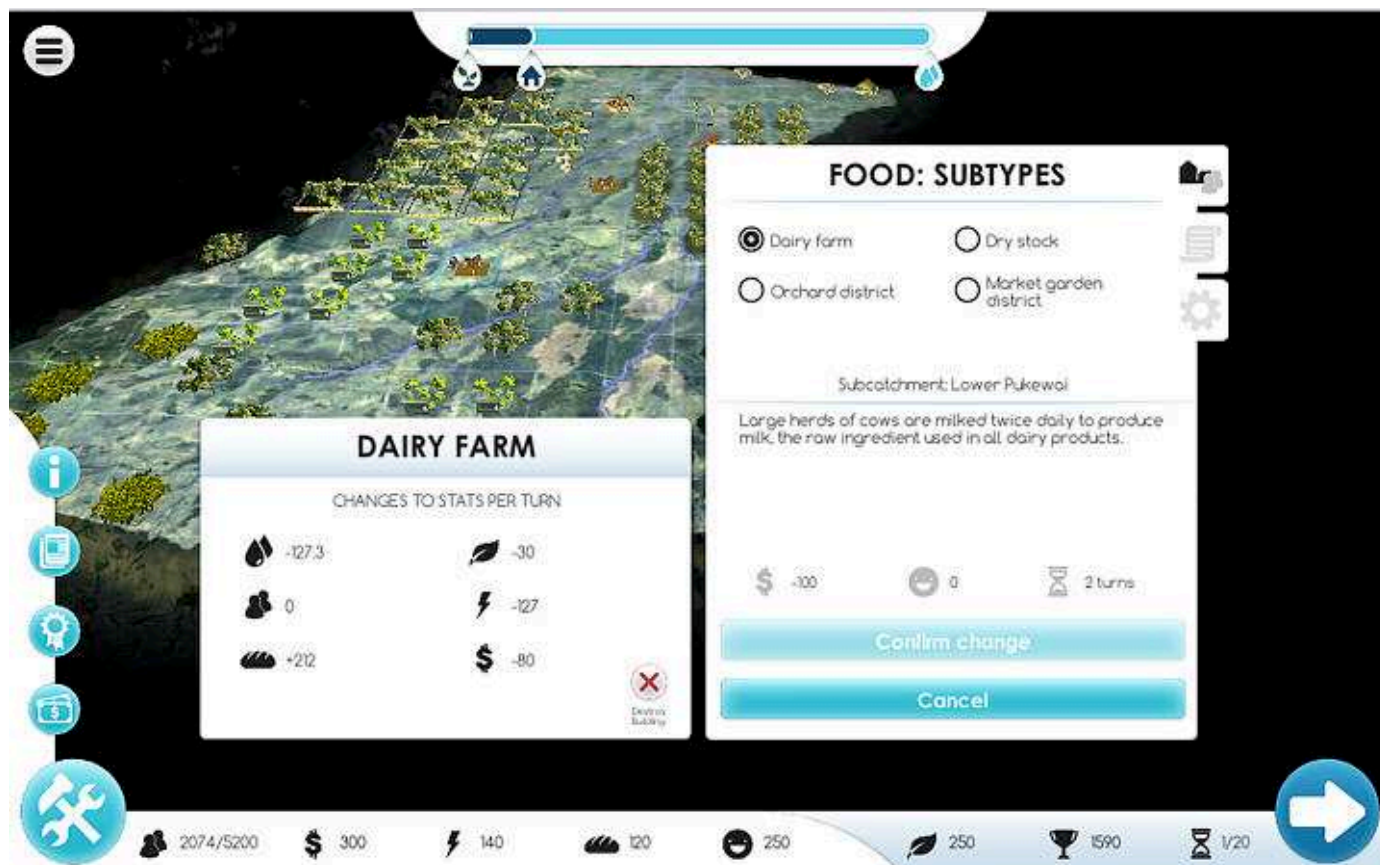


Figure 3. Screenshot of an example of different farm types in the game

sustainability – something we could see was a serious issue requiring greater attention. Another constantly reoccurring issue we were seeing, and still see, are situations where there is a lack of good decision-making, or even a complete lack of decisions, on how water should be allocated between various municipal, agricultural, industrial and energy users and uses, while also taking into account climate change impacts. What we wanted to do was to use a serious game to further the cause of sustainable development, with water as the connecting element that would promote policy-based actions that integrate climate change responses with holistic planning approaches. The big question though was, could it be done?

From humble beginnings, a lot of healthy scepticism from good colleagues, and numerous user pilot tests, Aqua Republica began to quickly evolve from half a page of A4 paper, to a board game and finally to a digital prototype that combined numerical models, a game engine, and an attractive but deceptively simple user-interface. The end result is a sophisticated game that reflects the challenges of real life. In the real world trade-offs between shorter and longer term development goals are often essential, but what is even more important

is the awareness of the broader consequences. This philosophy is reflected in Aqua Republica.

One platform, many unique versions

The foundation of Aqua Republica is the game platform. This consists of components that can be combined and/or modified to produce many different unique versions. In Aqua Republica a water allocation model (MIKE HYDRO BASIN) communicates and interacts with the game engine simultaneously, while the player is playing the game.

The water allocation model is widely used by different governmental agencies around the world to help in calculating and forecasting water balances in river basins, so that different scenarios can be analysed, as part of management decision processes. There is no better way to understand the physical environment and interactions in a river basin than to use the laws of physics and hydrology as part of the rules in the game. The game engine uses the results from the model that are linked to other parameters, such as population, economy and other social issues related to water. In line with the fact that nothing remains constant in real life, the interaction between the game layer and the scientific



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model produces evolving scenarios to which players must react and adapt. Experience has shown that this interaction between game, the scientific model and the player provides a really interesting and relevant learning experience for users. It can also function as a way of sharing and discussing scenarios based on data and model results with non-expert stakeholders. For example, a model using climate change data, using local water data and then linking up with local water issues in a game can help those who play the game learn many details of local water issues. Through playing the game, people become more interested in these issues and start to investigate and learn more about them, and come up with ideas that can help solve various challenges.

A typical version of the game starts by introducing players to Aqua Republica, before informing them that they have the responsibility of developing what is a small but ambitious nation in the most sustainable way possible. As the game progresses and time moves on, drivers such climate change, population growth and associated demands for homes and jobs, force players to adapt to survive and thrive. For example, should the strategy be to grow crops for food or biofuel, and if both, what should be the balance - given various alternatives and risks? Players quickly learn that developments are costly, take time to implement, and often impact the resource base on which they are reliant, as well as neighboring countries.

Uses and impacts

To date, there are many different unique versions of Aqua Republica developed to teach different aspects of water and environment management to different groups of stakeholders, ranging from food-energy-water nexus issues for water users in New Zealand, to water security issues for the Government of Singapore. Aqua Republica has also been successfully used in many other educational activities, such as the annual UNEP-DHI Eco Challenge competition, where more than 7000 students have participated since 2013, the World University Challenge, as well as part of Master and Bachelor programmes around the world. In addition, Aqua Republica has also been used in research projects where the objective is to continuously seek improvements on how to better use this technology to reach out to even more people.



Figures 4 and 5. Participants trying their hands on the Aqua Republica game at Stockholm World Water Week and Students in Kenya playing the Aqua Republica game as part of a workshop

“Wow! This is a lot of fun and we are learning so much about water, its uses and how important it is. Why can’t more of our lessons be like this?”

Timothy Yip, 14, United Christian College, Hong Kong

“These competitions are extremely important. As we activate the youth to take an active role and interest in water issues, we help to educate the next generation of water professionals.”

*Rüdiger Heidebrecht, DWA
(German Water and Wastewater Association), Germany*

“Aqua Republica is an excellent learning resource linking the Food – Energy – Water nexus ...”

Todd Jarvis, Oregon State University, USA



Figure 6. MSc students in McGill University, Canada using the Aqua Republica as part of an IWRM course

What’s next?

While we are very pleased with the uptake and positive feedback we have received so far, we are always looking for additional opportunities to collaborate and further develop the game. One of the most exciting projects we are currently working on is SIM4NEXUS. It is a Horizon 2020 European research project led by Wageningen Economic Research (the Netherlands), which brings together a multidisciplinary team of 25 partners including DHI. The aim of SIM4NEXUS is to address knowledge and technology gaps and thereby facilitate the design of holistic development

policies. The delivery mode is through a serious game in the form of a cloud-based, integrated tool for testing and evaluating policy decisions. This is done by combining a number of thematic models on water, land, food, energy and climate to quantify the impacts of different policy decisions. The aim of this game is still to help people better understand and evaluate the decisions that they are taking, based on the complexities of real life. In doing so, they will better appreciate the consequences of both action and inaction. ■