Online Game Technology for Space Education and System Analysis

Final Report

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DATE   2010-03-15

REVISION   1.0

Executive summary

Playing video games is a common activity for the youth of today and the functionality present in today's online games are likely to become the state-of-the-art for "Generation Net", the Space engineers, scientists and decision makers of tomorrow. To address this, the study "Online Game Technology for Space Education and System Analysis" was performed in 2009/2010 to assess options for ESA with regards to the use of online game technology (including so-called interactive learning tools or immersive learning environments), specifically in the areas of outreach/promotion, education and engineering.

The study looked at various options for delivering aspects of Game Play to targeted audiences, from the simplest casual and content-oriented games to immersive Massively Multiplayer Online games (MMO games).

This study was undertaken by MindArk PE AB (Sweden) which is well-known in the online games business as the developer and operator of the MMO game Entropia Universe. The study has been funded through the ESA General Studies Programme (GSP).

Players and stakeholders

From the start of the study, the target player group has been students (Secondary school, 12-19 years, and University level). In addition to this, the study has identified other important groups of potential players and stakeholders: Educators, Science- and Space-interested general public, Professionals (Engineers, Scientists and Space industry), Parents of students, (current) Gamers and the General public.

Several stakeholders (typically Parents, Educators) will need to be considered in the promotion and design of any potential product. In particular various ESA resources and representatives (ESA Teachers' network, ESA domain experts and other knowledge providers, Decision makers and Communications departments), Space industry (ESA contractors) and the National Space agencies will also be important to consider as both participants, content providers and sponsors of a successful game (educational tool) implementation.

The study suggests some measures to be taken in order to include players from one of the main focus groups: young women. Women and men do play the same games to a large extent but there are some game design features which can be included to enable attracting and retaining interest among women. For instance, tools for efficient building of relationships, role-play features (including an avatar system enabling customization and identification with game characters), supporting cooperative gaming elements, balancing core gaming with social activities and a careful choice of game themes. Similarly, in order to support players with physical difficulties the requirements and impacts on game design must be assessed at an early stage. This player group should be seen as a potential resource as reaching out to them can be more effective from an audience standpoint than looking into new delivery platforms. Regardless of group, a key task for a game implementation project is to get to know the players and stakeholders.

Scenarios for inclusion of game play

Playing games is not all about entertainment. Games have intrinsic properties of goal structures and interaction that make players set out on expeditions to gain in abilities and to unravel hidden secrets (knowledge), either on their own or in collaborative missions with other players. In addition to this, online games also provide the aspect of persistence where the game world is being updated by all players, thus adding to knowledge, challenges as well as allure. Persistent games can offer a story line that unravels information as players move forward, both working as an attractor and as a source of information. Online game platforms also offer various communication tools that can be used to setup ESA-related events in the game world, presenting recent findings or letting dispersed players get a close relation with ESA experts, acting as themselves or as game play characters.

These are properties that ESA can make use of and the study has identified seven application areas in which online game technologies can be beneficial to the agency:

Promotion for Space and the Agency's activities

An important part of the desired aspects of promotion are knowledge-oriented, focusing on promoting the existence of and results from Space-related research activities and technology development, and just support interest in "Space in general". Such activities can include future projects or upcoming space utilisation initiatives. In this scenario a game should first of all be used as an attractor to appeal to both the traditional interest groups and to players that will become the core group of the future.

Games can range from the casual, yet persistent variety (which create an online presence that can be used to deliver a variety of materials and episodes), to immersive exploratory environments where the players can live their intrinsic astronaut dreams. Public events in-game can be used to "breathe life" into the game, and to bring the players' attention to new ESA-related information to gain game advantages. However, in order to keep up interest with the audiences it is equally important to present a truly outstanding environment supporting the unique aspects from the space domain.

Education about Space, Science/Technology/Engineering/Math and related subjects

Games in general have been used in a variety of ways to support learning processes and online games can build and improve on this foundation. For learning basic facts the online games are comparable to any other game or learning environment, but they can add a social aspect through high scores and peer-challenges. Existing investments in subject-matter games can sometimes be used in a persistent online infrastructure, making the simpler games into missions in the larger setting.

The area where immersive online games excel is in exploratory learning environments, prioritizing learning by doing, and this can be a good match for many of the ESA subjects. Exploratory environments can be created as virtual laboratories, with so-called sandbox game play or open-ended simulation capabilities, connecting in a natural way by social interaction that makes a virtual world much more unpredictable and thus interesting. This also creates openings for in-game mentoring by students exchanging information with others. Open-ended games can also be used as what-if simulators, letting one group of students use their creativity to create virtual sets to be

explored by other students. Learning in a game environment can also include teaching and presentation of information in a general meeting setting or performing pre-(game)-mission briefings.

Still, it is crucial to find an attractive game setting that students will want to return to, simply for their urge to excel in the game itself where learning is a bonus. Thus game design must be focused on instilling emotions in the players, finding the balance between player skills and game difficulty.

Recruitment and promotion of the Agency directed towards professionals

Here, online games can be used as information tools and as meeting places. To inform and attract prospective candidates to the challenges and opportunities of working in the Space industry various process simulator games can be designed. Role-play can be managed through agency level management simulators that illustrate the variety of roles involved, for instance through MMO game play roles. Games can range from casual, social media-oriented games showing teamwork and collaborative aspects with actual undertakings, to immersive meeting places where candidates can meet ESA representatives and interact with them, including in game play.

Getting in touch with real-life ESA staff will be important in this scenario, and from that respect an active participation by ESA personnel in the game can be essential. For instance, as event presenters where interested participants can ask direct questions or get into a one-on-one relationship activity with a staff member. Games in this area will also be useful as education, for example, to educators who want to learn about the space industry to promote to or just support students with such interest.

Outreach and general promotion of Space Exploration and Agency activities

For reaching the less Scientific/Technology-minded audiences there is a need to focus on concrete issues like national contributions and artefacts relating to ESA activities that can be found in everyday life. Simulators can describe the process of research and development and the spin-offs they lead to, racing games can be presented with or without space research-related components.

An immersive environment as a homestead for ESA in the virtual world could be a good place to start the journey into making use of the power of "ESA Fame", ESA experts, authors or other national celebrities, for real-time events.

Supporting engineering activities and player creativity

Just as for other forms of education, game technologies can be useful in providing access to Science/Engineering-related information and knowledge, and supporting learning processes. Principles and process knowledge can be delivered and trained through simplified system simulators, process simulators and role-playing games where the player becomes the Virtual Engineer. Design-specific knowledge can be acquired and tried out in sandbox environments, so-called virtual labs. There, an actual design process can be followed and the resulting design be evaluated against virtual world rules, be assessed by other players, or be evaluated through competitions with other players.

This area would likely benefit from using online game environments as enablers of the exchange of ideas and experiences by creating interactive arenas, general meeting places where social

interaction around engineering subjects can take place with forms of player sightseeing, visiting the sandboxes of others as well as players showing off their design to others.

Supporting group activities and cooperative play

The key differentiators of online games compared to other forms of games are the opportunities to enable players to perform various types of *collaborative* and competitive activities in shared environments. This is an aspect that goes straight through all of these scenarios. Games can be used to foster problem-oriented cooperation where players join to solve an issue or build a robot; communications-oriented cooperation where players understand the issues with working in multicultural organizations; and relationship-oriented cooperation where the purpose is to get in touch, to build social networks and international friendship.

Cooperative game play means taking ownership, leading to engaged participation. Such games can be used as school collaboration tools where all players own pieces to the solution, to situations where players must collaborate to compete, for instance through "Engineering leagues" or other team–based competitions. For creative processes it is important to support sharing and provide "The Good Example", enabling players to not only experience but also to try-out what others have created. Here it is crucial to support good social mechanisms for meeting others, not only through pure technology mechanisms but through good game design.

Educator involvement in game worlds

Educators are key participants with regards to a game with educational ambitions and they are important to keep involved even after the educational content has been created. Game play elements can be included to enable in-game teaching events supporting a number of modalities but still with connection to game play such as rewards and providing additional missions. Educators can be in-game mentors, helping the players around problems, or game-masters that can control the level of difficulty or hand out new missions to players in need of new challenges. Games can also be designed with the educator in mind, both to help understand the subject being taught to the students and to help customize the students' experience in order to fit the curriculum.

Technology platforms

The study included an assessment of the technology platforms and architectures common in the industry today. The main finding from this activity is that it would be possible to support ESA interest areas (Promotion/Outreach, Education and Engineering) with available technologies, but not all by the same technology. Education/Engineering subjects generally require an immersive solution (3D world with interactive physics support) based on high-end or mid-range solutions whereas Promotion/Outreach subjects can do with mid-range to low-range solutions for browsers or lightweight clients.

Still, few technology offerings singlehandedly cover all requirements but through the use of middleware components it is possible to integrate the needed functionality. The main drawback of today's solutions is the lack of packaged server support. Few offerings focus on providing the multiplayer aspect as turnkey solutions, and here major custom development will be required, a better choice can be to look at one of the service solutions that are available.

The study also assessed available delivery platforms; the recommendation at present is to focus on the Windows platform to start with as today's alternatives in desktop platforms represent a very small percentage of potential players. Consoles can become just as important but due to an expected generation shift among the consoles in the next few years any development effort focusing on consoles should wait. Developing games for mobile delivery platforms is quite complex due to the multitude of target devices and is not considered a main path forward for ESA. However, games on mobile devices and consoles may prove to be complementary once a game presence has been established.

For several of the identified scenarios game accessibility (though a lightweight platform) is likely a key feature for attracting new players. However, such platforms generally lack the fidelity needed to enable the intended promotional effect and keep the core (knowledgeable) players interested. This can be achieved by implementing game scenarios that call for an immersive platform. The study recommends establishing a service solution for connecting several games. This allows a broadening of the game design options with a multitude of technical solutions, yet maintaining a single identity. Such a multi-game ("Hybrid-MMO") infrastructure could support several games in a single network for achievements and social interactions, making it possible to focus game play on specific business goals with each game deployed, thus supporting many of the game scenarios.

Options and challenges for the future

There are feasible alternatives for supporting the focus areas of promotion, education and engineering, either as separated games or as one connected game universe. The Space domain offers many appealing factors for designing game play of persistent games and can offer both informational and educational aspects as well as more eccentric Sci-Fi references. In contrary to popular belief, Game development on a professional level is a mature business and advanced games are possible to implement within realistic time frames and at reasonable costs. The key challenge is meeting the players' interests and for this reason the study recommends a staged model where various aspects of Game Play and content are introduced over time and player feedback is evaluated in parallel.

The study has identified several roadmap scenarios for delivering one or more games to the target audiences. Almost all of the main game scenarios are possible to implement in a rapid time frame, however not at the same time. The recommendation for a first implementation of an ESA game (online tool) is to focus on the scenarios of education and knowledge related promotion. Both of these include learning aspects, both focus on players that are likely to keep playing over some time. The two could also support each other in terms of player community: the promotion scenario can attract knowledgeable players that can assist in the learning processes, the educational scenario brings new content that is attractive to players interested in space-related issues.

The choice of game to implement depends much on the game ideas that can be generated. If exploratory learning is important, a small-scale MMO is the best starting point. This is also true for enabling a true ESA presence in the game world through live events. The step over to various collaborative scenarios is also small with such a solution. If the roadmap is focused more on

widening the player base to large numbers, an accessible persistent casual game (like a social media game, "Spaceville") can be an option, but with restrictions in the educational aspects.

An online game is a long-term investment, from both the game operator's and the players' sides. Players invest into their game play characters and expect this to remain (and change) over time. For this reason an online game operator must be willing to invest continuously in development, support and game content, activities that can become costly to uphold over time. The study recommends looking into *Public-Private partnerships* to support this. Besides the financial gains, there are advantages to the overall project including focus on the partners' knowledge areas, targeting of larger player groups and providing better and more content for the game.

Mock-up and Game concepts

As part of the study a visual mock-up of a future game environment has been developed. Recorded from MindArk's Entropia Universe it shows human planetary exploration on Jupiter's moon Europa in a distant future, displaying exploratory game play and highlighting learning aspects and event possibilities in an MMO game. The purpose of this mock-up is to illustrate the main findings identified by the study and the result is available as a video. Also, with the intention of visualizing the game scenarios in further detail examples of suitable game ideas and a set of detailed game concepts have been developed for future reference.

Conclusions

Regardless of chosen game scenario, technology or roadmap scenario there are some success factors to take into account for a game implementation and the study has identified a number of recommendations to take into consideration. Such factors have relatively little to do with selecting the optimal technology compared to the importance of designing the right game for the right audience and putting it into operation. One of the key decisions will be that of ensuring a sustainable undertaking, including a *self-sufficient financing model* that can ensure operations to persist beyond the first launch. Finally, a game with a grave or solemn direction and purpose is fine but a dull game is not – there must be some level of craziness to the material, the Fun factor must be possible to find in everything, and the quality of the experience must meet or exceed what the targeted audience is accustomed to.

Increasing the awareness and knowledge about Space are issues far too important NOT to be played out in a game. Playing games can be a motivating and enjoyable activity with beneficial applications outside the gaming environment. This study has shown that online game technologies can be powerful tools for ESA to use, and that games and interactive environments can be of significant benefit to the Agency beyond their entertainment value. It is clear that with all that ESA has to offer to its stakeholders, the Agency can and should play a significant role as the provider of qualitative, engaging and top-class game content.