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Polygons and practice in Skies of Arcadia

This paper features research carried out at the Victoria and Albert Museum into the design history of Sega's 2000 Dreamcast title, *Skies of Arcadia* (released in Japan as *Eternal Arcadia*). It was released by Overworks, a subsidiary of Sega, at an interesting point in Japanese computer game history. A new generation of video game consoles was in its infancy, and much speculation in the industry surrounded how networked gaming and large, open, tridimensional game worlds would change game design in the years ahead.

Skies of Arcadia is a game about sky pirates, set in a world where islands and continents float in the sky. I became interested in this game because it was praised in critical reviews for the real sense of place in its visual design. It is a Japanese Role Playing Game (JRPG), meaning that gameplay focuses on exploring a series of spaces and defeating enemies in turn-based, probabilistic battles using a system similar to that established by tabletop games such as *Dungeons & Dragons*.

This research is based on interviews with the producer Shuntaro Tanaka and lead designer Toshiyuki Mukaiyama, user reviews submitted online over the past 10 plus years, and historically informed design analysis. It is grounded in a broader study of the networks of production and consumption that surrounded and co-produced the Dreamcast as a cultural phenomenon, technological agent and played experience.

Through design analysis, oral history and archival research, in this paper I will complicate notions of tridimensionality by placing a three dimensional RPG in a broader network of sociotechnical relationships. Tridimensionality is not a trick of technology; it is a collaborative practice between player, designer and console.

HISTORIOGRAPHY

Video game architecture and space design has been treated in depth by researchers in game studies and game design practice, but little work has been carried out into the history of video games from the perspective of their inner spaces.

Steffen Walz's *Space Time Play* (Borries, Walz & Böttger, 2007) and *Towards a Ludic Architecture*(Walz, 2010) provided the basis for a spatially oriented games criticism and design theory in the late 2000s. These two works provide a survey

of architectural perspectives on gaming and ludic perspectives on architecture; theoretical sketches are complimented by taxonomies of spatial organisation in games and brief reviews of how games have used space in their design. They are extremely useful theoretical works, but as with game studies more generally, there has been no attempt to trace the socio-technical history of network relations that brought changes in video game space design into being. For a text targeted at design theorists and designers in training, this is not a serious flaw.

However, just as historical study is an important way of building citizenship in state schools, a greater understanding of the causes of design change and stagnation in the games industry over its history so far can help developers, critics and players to better understand how change could happen in the future. The technologically determinist account of video game design history suggested by the introduction to *Space Time Play*, whereby changes in the dimensionality and spatiality of games are caused by advances in hardware, puts developers and players in a passive role as the subjects of technology's ever progressing march into the future. I would argue, inspired by Bruno Latour's "Actor Network Theory" methodology (Latour, 2005) that design change occurs as part of a larger network of historical forces, a network in which all participants, both human and non-human, are actors with some degree of agency.

HISTORY

Tridimensionality had been a profitable gimmick in arcade gaming since the 1980s, but in the early 1990s, when Sony began building hype for the PlayStation, it became a major selling point for big publishers. Business analyst Nicholas Lovell recalled in an interview that the demos for the PlayStation, particularly tridimensional games such as *Ridge Racer*, gave the video games industry generally a new legitimacy as the enhanced legibility brought on by more advanced graphics technology made it conceivable that games could be understood and played by a broader audience (Lovell, 2012). The next generation of consoles—Dreamcast, GameCube and PlayStation 2 —competed heavily on the basis of their capacity for tridimensional graphics.

Skies of Arcadia was developed in-house by Sega to demonstrate the 3D graphics processing capabilities of the Dreamcast, and to give Sega an offering in the growing market for Japanese RPGs. The Dreamcast hardware, including its 3D graphics processor, is and was understood by most human actors in the network from a technologically determinist standpoint; the hardware would bring in the customers, inspire game developers, and enable new approaches to game design.

Shuntaro Tanaka was the director of *Skies of Arcadia* [1]. His own sense of direction in the project seems to have come from two main sources: firstly, his communication with his seniors in the company and the hardware division of Sega; and secondly, his perception of what the target demographic would enjoy based on existing cultural products.

1. Reflecting the international presence of Sega and other games companies, in this paper I refer to game designers at Sega and elsewhere with Anglicised name order—that is, family name last, as opposed to the Japanese custom of putting the family name first. This follows the convention in English-language gaming media, and it is how the individuals concerned refer to themselves around English-speaking people.

One case where direction came from above was in recognising the importance of the game as a product that would demonstrate the hardware capabilities of Sega's new console. Tanaka heard from the hardware division that the Dreamcast would provide unprecedented graphics processing power, and that Sega's consoles needed a large-scale RPG to rival *Final Fantasy* or *Dragon Quest*, (Tanaka & Mukaiyama, 2011) both of which ran on Sony's PlayStation. By 1999 RPGs were perceived to be a very profitable genre; the Nikkei Weekly conjectured that it "could revive the games industry" off the back of the 17.88 million units of *Final Fantasy* games shipped by Square by the time *Final Fantasy VIII* was released (*Arcade, home games to be compatible*, 1999). Sega was suffering significant commercial and financial problems due to the perceived failure of their previous console, the Saturn, so they needed the Dreamcast to be a major success.

On world design (sekaikan), Tanaka's direction came from other cultural products that were held in high esteem, such as the anime films of Hayao Miyazaki. This quotation of familiar images and products was well-received by fans:

> When I was a child, big warships and the Metal Max series [2] left a deep impression on me. If you liked this sort of thing too, you'd enjoy this game. (Nanjayo, 2007)

When interviewed, games developers working in the late 1990s seemed ambivalent towards Sword and Sorcery themed RPGs. While the roots of the game genre lie in *Dungeons & Dragons* tabletop RPGs, Japanese RPGs had been drifting away from these origins in the 1990s, most notably in the *Final Fantasy* series, which had introduced elements from Japanese myth and legend, and cyberpunk aesthetics. A graphic designer for Vagrant's Story, released in 2000, said with a note of pride that he "wasn't familiar with the sword and sorcery look," so his enemy character designs looked unconventional and fresh (Studio Bentstuff, 2000, p. 487).

Tanaka reported that the original RPG that Mukaiyama had been working on for the Sega Saturn was to be a traditional sword and sorcery themed game. Once Tanaka joined the team he introduced the new theme of sky pirates, and the team began to work towards the game that would become *Skies of Arcadia*. He said that there were many reasons for this choice of theme, and highlighted two particularly important factors. One was his belief that a game world inspired by Miyazaki's *Laputa: Castle in the Sky*would appeal to the target demographic of teenagers and "people who like anime and manga." Implicitly, sword and sorcery themed worlds did not hold the same appeal. In addition, he believed that the theme would make it possible to show off the polygon 3D capabilities of the Dreamcast, since airships could view landmasses from any angle (Tanaka & Mukaiyama, 2012).

Coeval with the push to demonstrate the new hardware features of a next generation console was perhaps the notion that a next generation game should push frontiers artistically as well as technologically. Therefore, the game world did not have to be just large enough and three-dimensional enough to impress players, but it also had to have a refreshing setting to garner real attention.

2. An RPG series for Nintendo consoles that featured vehicle combat.

The turbulence and power games of an age of empires and piracy may have been evocative of the exciting state of the industry in the late 1990s, as game designers looked forwards to a new age of networked, fully three-dimensional, open worlds for virtual roleplaying. This was a time when many game designers were developing new technologies and skills in anticipation of the next generation of games. Perhaps this was analogous to the new world mythos of empire and piracy. This optimistic sense of being on the cusp of a brave new cyberworld would have been supported by the euphoria of massive economic growth in the software and IT industries during the dot com boom.

One common issue that arises in retrospective interviews with game developers working in the late 1990s is whether the team possessed, from the outset, the skills required to make games for the next generation of consoles, and how they trained in those skills if they were lacking. The interviews I will quote below show that it was uncommon for Japanese companies to headhunt expert designers and programmers who could bring a new skillset to the studio. Instead, employees would remain on the payroll even while working on projects that would never make it to market, in order to develop the skills required to make later, high budget titles. This was the case with *Skies of Arcadia*, as Shuntaro Tanaka explained in our interview:

> We didn't have any experience of making large-scale RPGs, [3] […] I hadn't come in yet, but Mukaiyama was there from the start, and at that time [the console was] Sega Saturn. So for two years they were working with the Saturn. They still weren't able to make anything out of it when Sega announced that [the console] wouldn't be Saturn, but they were releasing some [new] hardware. It turned out that they were going to release the Dreamcast, so the plan changed—they weren't going to make it in time for the Saturn, so they [decided] to make a game for the Dreamcast. I came in shortly after that, and since it was to be the Dreamcast, the hopes for the game and the story totally changed, so we started from scratch and it took another two years after that. (Tanaka & Mukaiyama, 2000)

Tanaka's previous work had been in Sega's tactical RPG and dating sim [4]franchise Sakura Taisen, and he was brought into the project when the switch to the Dreamcast was announced. From there on, any experience in gameplay development gained by the existing team from their two-year attempt to create a large-scale RPG was applied to a new project, with Tanaka as creative director. Rather than hire someone from outside with prior experience in large-scale RPGs, Sega made use of the talent it already had in-house.

Retrospectively, developers are prone to describing projects that led to published games as though they too were training exercises, perhaps particularly if they were not high-budget titles within large franchises bringing in huge revenue for the company. Matsuno recalls that although it was made for the PlayStation, *Vagrant's Story* was made with a view to building the 3D polygon design skills that would be required to make next-generation games on the PlayStation 2.

3. The term large-scale was used in this interview to refer to games such as *Final Fantasy* and *Dragon Quest*, as opposed to tactical RPGs or smaller RPGs such as *Pokémon*.

4. A note on genres: tactical RPGs focus on the location and deployment of troops in a field, whereas standard RPGs focus on the combat actions of a small party of characters. Dating sims are dialogue-driven games that provide players with a series of multiple-choice decisions about what to say and do in an attempt to win the affections of the characters.

> We figured it would be the last game we make for the PlayStation. After that, we would shift to next-generation consoles such as PS2, Dolphin [later known as Gamecube] and Dreamcast. So we thought rather than make a 2D game, we should get a 3D game under our belts. For this game, we gathered together a lot of people who had worked in 2D games, so Vagrant's Story was the first time they had built up the know-how for polygon 3D games, for both graphics and programming. That was our starting point for the project. (Studio Bentstuff, 2000, p. 8)

Matsuno later worked on *Final Fantasy XII*, and introduced to the franchise stylistic themes he had developed in *Vagrant's Story*. Other members of the design and planning teams also attested to the fact that the biggest challenge in making *Vagrant's Story* was developing skills in 3D real-time graphics.

> Personally, I was interested in what we would actually be able to create graphically. A lot of people working on this game had been making games since way back. I wondered what they would be able to do when we were making graphics for the PlayStation. By gaining some know-how in that area, we might be able to further advance real-time graphics when hardware capacities go up a notch with the PlayStation 2. […] This was the first game I had made in full polygons, and I realised that everything I had learned making 2D games would still help me. Expressing things in very few polygons, reducing the number of colours to increase processing times, things like that had us using the same skills that they were using when they made dot images for the Super Famicom. For example, even with the PlayStation 2, there will still be limitations on memory and processing capacity, so at the end of the day what determines the quality of our work is our prior experience. (Studio Bentstuff, 2000, p. 487)

The suggestion here is that by developing an advanced game within the technical limitations of the PlayStation, they would be better equipped to make maximum use of the superior hardware capabilities of the PlayStation 2 in later games with larger budgets and greater expectations, such as *Final Fantasy XII*. When it came to 3D polygon-based design, there was a similar sense of being on the cusp of a great technological leap, but the designers interviewed focused on the ways in which their existing skills allowed them to make this jump successfully.

> Everyone made polygon models and also made dot images, and I think that's how we were able to make a game like this. In the end, when it came to character expressions and scenery, we were making those polygons using the same techniques that people working with dot images had always used… I like to have technical constraints… drawing something in three dots that you would have drawn in ten… without technical constraints, it's not as interesting. (Studio Bentstuff, 2000, p. 41)

Skies of Arcadia has a very similar backstory. The 3D polygon-based aesthetic that Tanaka first worked on here was later applied to his more commercially successful project, *Valkyria Chronicles* (2008). Clearly, at both Sega and Square at the

end of the 1990s, there was a sense that polygon-based 3D worlds would be very significant for future games development, so projects were taken on that would allow design teams to build up the necessary skills. At Square, the skills developed while working on *Vagrant's Story* were put to use in *Final Fantasy XII*, and at Sega a similar training process led from *Skies of Arcadia* to *Valkyria Chronicles*.

This offers one answer to the question of significance with relation to 3D graphics technology—technically significant games trained developers in the skills required to make later games that become prolific.

DESIGN ANALYSIS

In this design analysis, I will demonstrate that *Skies of Arcadia* was not just designed to showcase hardware, but that verticality was used in architectural designs for narrative effect, constituting a historically-situated "narrative architecture" following the game design theory of Henry Jenkins (2004). Tridimensionality emerged as a narrative and experiential practice, rather than a technological flourish.

Skies of Arcadia is a game-world made entirely from polygons, with no use of background images to give an illusion of perspective projection on a flat plane. A world made of polygons is three-dimensional from a visual point of view, but the control degrees of freedom can range from one—for example, if the game world were to automatically move past the character, and the player could control only whether to jump or duck—up to six in, for example, a helicopter simulator in which the players could control movement along three axes and the tilt, roll and yaw of the vehicle itself. In *Skies*, players are only able to move on-screen characters along a maximum of two degrees of freedom at any given time; while on foot they can move the character forwards and back, right and left, and while on a ladder or pole players can only move the character up and down. So the world is three-dimensional, but the control degrees of freedom are no greater than can be achieved in a two-dimensional game-world. Players are also sometimes able to move the camera along another two degrees of freedom: up and down, and left and right.

This is common for RPGs, and could be compared with action games such as games from the *Tomb Raider* franchise, which typically give the players six control degrees of freedom: the playable character Lara Croft can be moved forwards and back, left and right, up and down (by jumping, crouching, climbing and falling), oriented right, left, up and down to face different directions, and even made to turn upside down by cartwheeling (Core Design, 1996). This is a key differentiator between RPG and action gameplay, and makes different demands on the player's skill.

This shows that tridimensionality was not just a question of using a graphics card to create game worlds made of polygons. It was also important to consider the interaction design in the game mechanics: the control degrees of freedom given over to the player affected the extent to which a game felt tridimensional.

TOWN AND DUNGEON

In order to draw attention to the polygon tridimensionality of the game and, by extension, to the graphical capabilities of the Dreamcast itself, *Skies of Arcadia*'s architectural designs created dynamic topologies to permit movement along the vertical plane without increasing the control degrees of freedom.

Pirate Isle, the home of the main characters, is an example of a town map where the ground elevation is arranged almost as a corkscrew; the lowest part of the island is an underground secret base, which contains three floor levels that are scaled by a variety of ladders, ramps and poles. A door from the underground base leads to the outer edge of the island, where a path circles up and around the outside to the main village buildings and further up and around to the top floor of the windmill. The buildings and windmill are both connected to a wooden mezzanine that leads upwards to two separate, small islands; one acts as a jetty for small ships, the other is used as a lookout post. This is one of the earliest areas accessed in the game, and it demonstrates the tridimensionality of the game world very clearly through architectural verticality.

Horteka is a rainforest island which also employs wooden mezzanines, in combination with zipwires, poles and ladders, to navigate between straw huts and treehouses. Poles and zipwires are particularly well designed for demonstrating the tridimensionality of the space in terms of depth. Movement down them is smooth and dynamic, and foreground elements such as leaves and branches briefly move past the camera to emphasise proximity and distance.

Shrine Island is arranged as three concentric circles; the outermost circle contains a lake, and is joined to the inner two circles via a long, narrow path. This narrow path leads towards the large structure of the shrine itself, which looms ever closer towards the camera as the player pushes the character forwards. Another concentric circle leads around the shrine, but access has been cut off by debris, forcing players to access the building through imposing doors. All of this emphasises the scale and volume of the building.

SKY AND SHIPS

The tridimensionality of the sky maps, across which the player-character must travel in a ship in order to get between the floating islands that house towns and dungeons, allows players to move along three degrees of freedom. The gameplay features of the sky map require skillful maneuvering of the ship, particularly when attempting to catch fish as they swim through the sky by flying directly into them. While the first ships piloted in the game do not feel conspicuously slow to respond, there is a significant change in ease of response when the characters come into possession of the Delphinus. The Little Jack, the ship featured in the first half of the game, responds too slowly to follow fish that have swum behind the ship. The Delphinus, however, can spin around very rapidly, making it possible to catch fish with greater speed and accuracy than before.

The simulation of control systems was an interesting issue for Dreamcast games at the time. *Sega GT* (Sega, 2000), a racing game made by Sega, used the processing power of the Dreamcast to offer supposedly realistic simulations of the experience of driving the models of sports car offered by the game. This notion of realistic simulation was taken further with the release of steering wheel controllers for the Dreamcast. The notion was that core features such as steering response, acceleration, brake speed etc. were accurately transferred into algorithmic properties of the cars featured in the software and then fed back haptically into the controllers.

In *Sega GT* and other racing games, player progress is rewarded by unlocking more advanced cars and more challenging and exciting tracks. The goal of the game is to win races with inferior cars in order to be able to participate in better races with faster, more responsive cars. These games distil the challenge-reward mechanism of game design in a much simpler form than the sprawling, multi-layered gameplay of RPGs. A variety of challenges are made available to players, designed to feel difficult but achievable; players select a challenge, and if they complete it they win more challenges and more tools that they can use to complete those challenges. An important factor here is the player's sense of agency in their choice not only of challenges, but of which rewards to apply to solve the individual problems posed by each challenge.

Of course, the flying ships of *Skies of Arcadia* were not designed to be realistic simulations of what it would be like to sail a ship in open air. However, a similar logic of technical impressiveness regarding the air ships in *Skies of Arcadia* was applied to the sports cars in *Gran Turismo*; quick response times were impressive features designed to wow the players and serve as a reward for progress in the game.

The technology said to determine the capabilities of ships in the game world are able to be installed as interchangeable hardware of the ship itself. Different cannons can be bought or won and used to increase attack power in battle. Other hardware allows the ship to sail through reefs of rock or sky walls. Here, the same logic that is seen in racing games is again applied to the ships of *Skies of Arcadia*; players are rewarded for their success in ship battles with superior hardware, and they then have the choice of which hardware to install before attempting the next challenge. This same logic applies to the games console itself; the value of technological commodities is arguably promoted here through gameplay performance.

The tridimensionality of *Skies of Arcadia* is not simply a natural result of the construction of the world from polygons, nor can it be summed up as the number of control degrees of freedom. More complex issues of game design make the game feel more three-dimensional than previous RPGs, which allowed a similar number of degrees of freedom despite being rendered partly from flat images, such as *Final Fantasy VII* and *VIII* (Square, 1997; Square, 1999). The ability to traverse the sky in an airship gives players three control degrees of

freedom and allows the world to be viewed from any angle. The architectural design of the game world arranges passable space and impassable structures to create pockets that emphasize movement around structures rather than across the two-dimensional ground plane. Varying ground elevation and the inclusion of ladders and poles highlights the three-dimensionality of structures through player movement, as does the manipulation of viewer sense of scale.

VERTICALITY AND NARRATIVE

A 3D platform game released by Sega one year after *Skies of Arcadia*, *Super Monkey Ball* distinguished itself by its emphasis on the vertical dimension. Level design played on pillars and castle turrets to visually highlight verticality, gameplay introduced falling as either a failure or a short-cut to success, and the optical distortion of its wide-angle view further added to the sense of near-free fall (Johansson, 2007). In *Skies of Arcadia*, verticality is skillfully employed in architecture to emphasise the tridimensionality of the game-world and contribute to game narrative.

Height is mobilised in architectural design to narrativise the political differences between civilisations in terms of character agency. Under benevolent regimes such as Pirate Isle and the rainforest land of Horteka, it is easy to travel vertically by climbing ladders and poles. More controlling regimes such as Valua restrict the characters' movements, particularly along the vertical dimension. Valua is divided into the upper and lower city, and the upper city is restricted to only those of a higher social class. Forbidden routes through Valua are achieved via the underground catacombs, which are populated by monsters that the characters must fight in order to pass through. The use of underground architecture for subversive action is established on Pirate Isle, where all buildings and objects that relate to piratical activity are located in a secret underground base.

This equation of height with power lends itself to a reading of Arcadia's architecture as panoptic. In some ways this is true. Valua features many electric searchlights that glare down on the characters from above, at one stage in the game actually posing a real threat as being caught in the searchlight generates a battle with a set of deceptively powerful robots. The sixth civilisation's location in upper sky above the rest of the world is reflective of their aloofness and ultimate power to destroy the rest of the world in an instant if they see fit. However, both in terms of the storyline and the game's artificial intelligence, there is actually nobody behind the searchlight watching the characters. They are able to spend the whole game travelling the world freely, and when they do run into Valua they fight ship to ship as equals. A great deal of the power held by the enemy forces is not a result of their height, but of their technological power. So, while architectural height does contribute to an awareness of control and aggression, this is only in conjunction with the theme of technology, weaponisation and geographical power.

CONCLUSION

This paper has taken *Skies of Arcadia* as an example to look at tridimensionality in its networked historical moment. With the release of the Dreamcast and the in-house development of games such as *Skies*, Sega was pursuing tridimensionality as a strategy in hardware, business, design and staff skilling. Tridimensionality affected games as a business proposition, a design challenge and a craft skill.

The need to promote the Dreamcast and offer something unique and progressive also influenced the scenario design; floating islands and sky pirates allowed the game to demonstrate not just tridimensionality but also artistic novelty, while harking back to Miyazaki's nostalgic anime. Business imperatives and the possibilities introduced by new hardware were not the only determinants of tridimensional space design; tridimensionality also served the game's narrative architecture.

The nature of tridimensionality goes beyond the construction of a game-world from polygons. The number of control degrees of freedom available to the player affect how tridimensional a game is from the point of view of interaction. When the number of control degrees of freedom was limited, architectural design introduced tridimensional interaction without making extra demands on players' skill.

Design strategies that constructed tridimensional spatial challenges were not simply dependent on polygonal graphics technology. Level design strategies created paths of movement in three-dimensions, and players' operation of the game brought that movement into force. Tridimensionality was a collaborative product of technology, business, design and player interaction.

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