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There's More than One Way to Skin a Game: Templating Game-Based Learning

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Abstract: This work in progress paper documents our experiences in academic game development as we shifted from custom-built game designs to a templating approach that could more economically adapt our games to meet the needs of different disciplines. We assess our previous games content and structure for its suitability to fit such an approach and start developing a framework for our future work within our specific constraints.

Keywords: Academic Game Development, Educational Games, Edutainment, Game Development Process, Game-Based Learning

1. Introduction

Making educational games within academia is an effort to meet the needs of educators and students while working with far less resources than found in the commercial sector, amplifying the typical game development constraints relating to time, money and skill (Morrell et al. 2022). While the utilisation of commercial off-the-shelf games in education is a valid economic compromise (Van Eck 2006), it has only grown more difficult to adapt such products as their technologies continue to advance across lines antithetical to modding accessibility.

The intentions of our in-house development team, situated within the Aalto Online Learning-Online Hybrid Lab and serving the staff of Aalto University as our clients, was to avoid work reliant on existent commercial properties and instead aim to create original designs grounded both in research on education and game design. Our work now focuses on developing suitably resourced, realistically produced, game *templates* that can be modified quickly and with minimal friction to meet the needs of educators across disparate disciplines.

Our process is to develop an approach of modular and adaptable game development, with the individual mechanics and combined genres of games being developed distinct from the specific educational material provided by clients. This approach would ideally compile any delivered learning content with the structural template of a game, whose operation could then be rapidly evaluated as either a disposable disarray of elements or ideally, working with enough harmonious synergy to provide some foundation for further iterative development.

This templating approach aims for genre conventionality over any *sui generis* of a game, focused on building moddable elements within a standardised framework to potentially accommodate a variety of educational content. Through this assembly of atomised game elements, from game mechanics to *game design patterns* (Björk & Holopainen 2005) we would aim to attach enough hooks to hang any pedagogy as prescribed, benefiting those educators uncertain or unable to commit to more bespoke design solutions.

This paper documents how our template approach has developed from the knowledge gained during our previous work with educational games. We specifically discuss how our perspectives on design have adjusted within the constraints of academic game making and although important to reflect on later, the related educational model and learning outcomes do not fit within the scope of this paper. In the next section we first discuss how we approached re-utilising assets from our previous educational game work. The section following explores attempts to similarly reutilise the structural and educational components and the issues that emerged in that process. Finally, we briefly discuss how we expect our process to continue, in the pursuit of more efficient and feasible educational game development.

2. The Birth of a City

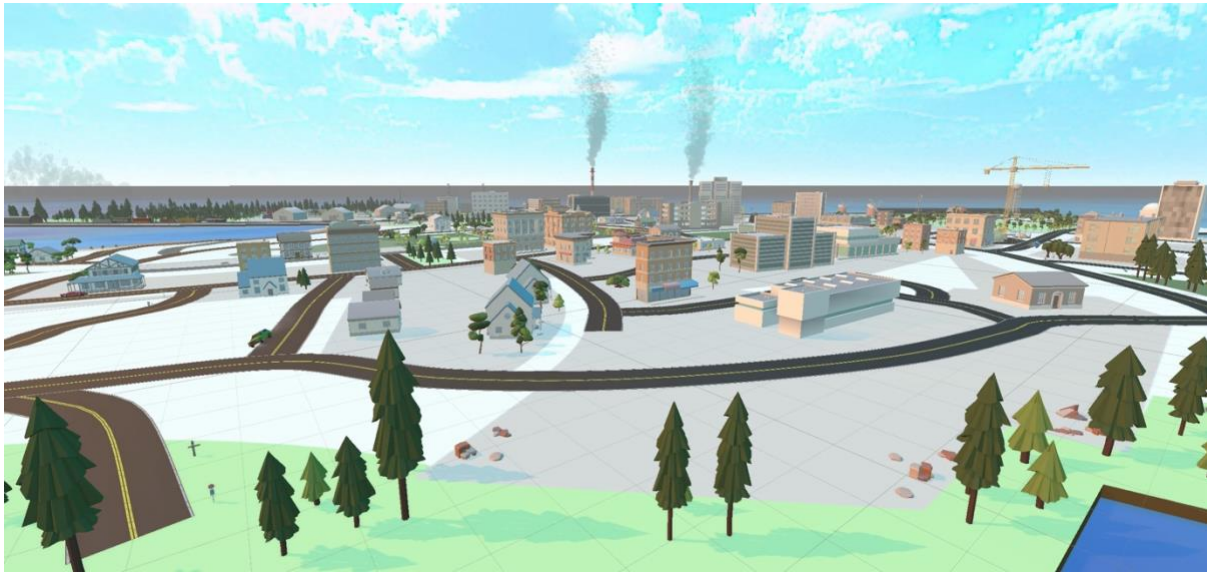


Figure 1: In-Engine Screenshot of the City Environment

One of our long-standing aims working with games has been to combine learning with technology in forms that can be easily modified and reused beyond their initial development. Our ‘Playable Concepts’ project exemplified this idea, interpreting themes such as burn out or leadership with singular game mechanics and simple 2D art, released alongside their source code and a Creative Commons licence (Kultima et al. 2020). Our following ‘Promotypes’ (*promotional-prototypes*) project moved beyond isolated game mechanics to produce several short but more involved games, demonstrating some of the styles of play we thought most relevant to educators - such as problem-solving, spatial navigation and the application of knowledge (Morrell et al. 2023). The development process of ‘Promotypes’ was challenging as multiple games with distinct art styles were being developed in tandem by our sole game developer. As the development process ran overlong, our overarching goal of having these games being reusable became secondary to having the original games released in a completed state.

Our experiments in ‘Promotypes’ included short games in the text adventure, 2D platformer and 3D exploration game genres, all being serviceable if lacking in educational content beyond the addition of text providing historical context about their genre precedents in commercial games. A significant amount of development time was focused on one ‘Promotype’ game titled ‘Cost Driver’ that more directly integrated course material from an introductory accounting course. The scope of this game quickly escalated once our theme was established - the player would learn about key accounting terms and concepts from different characters while working as a delivery driver over the day, culminating in an accounting exam. This led to the development of a large three-dimensional city environment, complete with various traffic AI systems and vehicle mechanics. Despite utilising pre-made building and prop assets, significant design work was associated with first sourcing and then assembling these assets together across a large game area with a sense of aesthetic coherence and geographical accuracy (loosely following the road layout of a real town). Our initial conclusions following the release of ‘Cost Driver’ were that we had to avoid developing such extensive 3D environments in the future, considering both the development time cost and the complexity involved with modifying it further. After some more distance from release, we revisited these conclusions.

Our context of academic game making (Gómez-Maureira et al, 2022) allows us to more visibly reuse artistic and technical assets across multiple games as they target discrete audiences of learners. The development time involved with creating the city environment was at too large a scale to be modified for multiple games. However, when we considered the environment as a relatable setting to act as a canvas for other educational games to be built upon, the value of the existing work grew. While not suitable for every use case, we still felt the city could be utilised across multiple game genres compatible with educational games, justifying further development, for example, on graphical optimisation and improved AI systems. More relevant to our local clients, the city environment could, over time, be transformed to replace the stock individual buildings and props for custom built assets matching the Finnish aesthetic and architecture, adding more regional flavour and cultural relevance, values that can often be integral to games funded in the academic setting.

3. Structural Integrity

With 'Cost Driver', we worked with an educator to adapt key vocabulary from their course material into a narrative themed game, with examples of the terminology emerging through branching dialogues around the city. The mechanics of navigating the city in a vehicle, making deliveries on time and recording the learnt information were implemented in a functional way, while the educational content was largely integrated through an extensive script that attempted to naturally explain these specific concepts through dialogue scenarios.

The simultaneous development of the script, environment and game mechanics were the work of a single developer whose process wouldn't form a cohesive whole until late in the process. While a more playcentric design process (Fullerton 2014) could have helped us to identify issues with the game design earlier, until the script was complete, we felt it was not possible to assess how well the players would be learning the content. Concerns from our designer were reinforced in the later testing, that the slower paced 'visual novel' style story elements were too abrupt a shift in pace to the much faster 'driving game' sections that connected them. The gameplay mechanics of driving and conversation felt incompatible, and this was difficult to rectify. Solutions such as editing the script further or moving more of the example scenarios into the world through props rather than through script alone were not enough to resolve the game's inner friction.

Our first efforts towards the concept of templating were in reverse engineering 'Cost Driver' to assess what mechanical assets were salvageable and what educational content could be replaced or reskinned within the framework. As demonstrated in the frame game concept (Thiagarajan & Stolovitch 1979) there is a dichotomy between a game's content and structure that allows for untrained users to modify a game's content while having it remain functional within a predefined structure of rules and procedures (Bekebrede & Champlin 2022). This concept is complementary to our ambitions with templating games, with one additional distinction - between educational content that would ideally be swapped out alongside our partners and supporting content that helps connect this with a structure supporting specific learning objectives. With 'Cost Driver', the parallel development of narrative and mechanics resulted in the educational content, the supporting content, and the structure being interwoven in a way that made them difficult to examine separately.

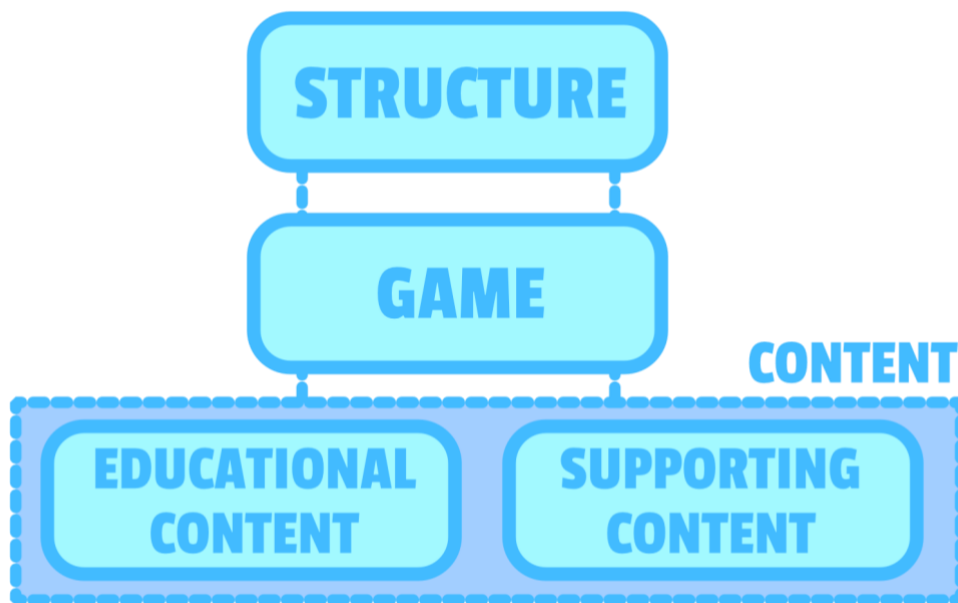


Figure 2: Expanding on the Frame Game Concept (Thiagarajan & Stolovitch 1979)

We had envisioned that the script used in 'Cost Driver', teaching accounting concepts through light comedic dialogues, could be swapped out easily for another script based on entirely different educational content. While this would be the main differentiator, several other assets could be modified to reinforce a new theme, from the in-car audio files to the imagery of billboard advertising. Still, replacing the script did not resolve the issues found within this clash of fast and slow game genres with the original structure. Another approach was to separate the extensive piece of written content, the dialogue script, and present it in a more complimentary structure such as the text-based game engine *Twine*. However, owing to the dialogic nature of the script being absent any descriptive prose, the process of engaging with it by text alone felt incomplete. The genre

incompatibility in the structure, alongside the tightly integrated educational and supporting content left us with a bespoke game that was costly and limited in future application. Our future work would plan for a game's structure and content to be better distinguished and operate in some form independently, before combining them, ideally forming the templating approach.

4. Future Expansion

The benefits of developing a city environment more customised to our locale is to provide a relatable background that could incorporate a variety of genres relevant to learning objectives. The literature has listed genres as diverse as Shooters, Action/Adventure, Fantasy/Role-Playing, Sports, Simulation, Puzzle and Quiz/Trivia games being relatable to specific learning techniques and activities (Rapeepisarn 2008, Silva 2020). A focus on the structure of genres with a standardised set of expectations will provide a more adaptable frame for incorporating content. Our previous development work has produced a variety of content that is reusable and understood in-house, such as the vehicle control system, and it is from systems like this that we can extract further value from our time. In isolation the driving games are not directly compatible with learning techniques as above but would still constitute an expected part of a broader educational game in the Action/Adventure genre. We continue to develop a first-person 'escape room' puzzle game using parts of the city as a thematic and lively backdrop, and development continues to envision a third genre, Simulation, that would have the player act as a city planner while viewing the environment from a bird's-eye perspective.

Going forward, we are still to finalise the templating approach, but we are taking steps to understand it better. We know that much of the difficulty emerged in our shift from 2D to 3D game design and it has required us to better focus our finite resources towards developing those assets which have the highest likelihood to be reusable across varying contexts. Before we can proceed with templating, we need solid games that demonstrate a more harmonious combination of contents and structure, working together to meet learning goals. To achieve this, we aim to build more traditional structures with an adherence to genre convention, while following a more manageable scope. If multiple genres can be constructed in this fashion, and validated through testing with learners, we could experiment in combining genres again and perhaps discover more original game designs. Until then, we will continue building dependable structures, forming recognisable genres, and working with a variety of educational content until we find that winning combination to act as our exemplar game template.

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