Formalizing Non-Formalism: Breaking the Rules of Automated Game Design

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ABSTRACT

Automated game design (AGD) is an exciting new frontier for generative software and games research, one which intersects many areas of AI as well as cutting across the many creative domains involved in developing a game. However, there is a trend throughout existing automated game design work to concentrate primarily on the rules that underpin a game – objectives, obstacles, and the notion of challenge. This paper examines this trend in automated game design, and argues that a broader understanding of games is needed. We examine the history of AGD to date, and consider this work in the context of game design theories and definitions. We discuss the term *secret box* to describe a class of game that does not fall into the purview of existing AGD approaches, and offer a design sketch of an AGD system we are building, *ANGELINA* 6, to begin to challenge these ideas.

1. INTRODUCTION

Automated game design (AGD) refers to the procedural generation or redesign of entire games. What constitutes an "entire game" is still loosely defined in the procedural content generation (PCG) community where most AGD research resides; AGD as a distinct area of research is still emerging. However, trends are beginning to be visible in work coming out of this area, and one such trend is a distinct focus on rules or game mechanics as the defining feature of an automated game designer. AGD systems will commonly assemble games using an emergent process, exploring the combinatorial space of the different rules and rule elements that form the knowledge base for the AGD system.

Recent years has seen the question of *'Is this a game?'* surface in the games community. The question is asked in a variety of contexts but often has a political subtext, whether or not the asker intends it. It is often asked of videogames which eschew traditional videogame themes, structure, tropes, or otherwise ignore the status quo. This is problematic for a number of reasons: it stifles the growth of games as a medium by emphasizing conservativism, and it has uncomfortable intersections with privileged sections of the games industry whose tastes dictate the kinds of games that are produced.

When building creative software such as AGD systems, we codify and define elements of the domains that we work in and the design methodologies used to create them. AGD systems are both built upon an assumption of what games are and constitute a generative definition of the same. The creators of automated game designers are encoding a set of assumptions of what a game is and what an appropriate process for designing a game could be. Most current AGD systems make the statement that games are a set of rules from which aesthetics emerge and in which art and music are largely window dressing. The systems typically ignore the play experience and the player, in favour of a formalist, structural, mechanics-privileged approach to game design.

This mechanics-first view on games is unnecessarily limiting, stifling the creative potential for AGD and restricting the kinds of games that can be automatically designed to ones that have well-defined, simple rule systems. The focus has largely been on how to generate games that are "correct" or "valid", and labelling these as sufficient qualification for a game to be "playable". Non-formalist design, on the other hand, prioritizes aesthetics, invoking an emotional response in players, and places an emphasis on the play experience: playability from this perspective refers more to the capacity a game has for encouraging a player's playful behaviour than it does a notion of formal validity.

These concerns may seem academic, given AGD's current distance from real-world game development or the debates that accompany it. Unfortunately, the opposite may be true: by building software, frameworks, design methodologies and models we codify and define aspects of videogames and their development process. If these structures become widely accepted, the result is that they guide thinking in the future, for both the authors of future generative systems and game developers more generally.

We argue for the importance of adopting a so-called "non-formalist" view on games in AGD: prioritizing the game's aesthetics and player emotional response as a first-class concern about which the AI can reason. We argue for the consideration of a broader definition of "games", especially ones that are not built heavily around rules and systems, and that instead aim for tightly crafted aesthetics. In doing so, we acknowledge that we are advocating for a kind of formalism of non-formalist thinking about games, by proposing that we build a formal, generative computational model of aesthetics

and play.

If AGD takes an aesthetics-first approach to game design, there are several potential benefits. The primary benefit is the promise of new kinds of play experiences that come from on on-demand game designer that can invent aesthetically-driven games. Secondarily, there is the potential for a deeper understanding of game aesthetics themselves through building a formal model that treats them as a first-class design consideration. This understanding emerges both through the processed followed in the building of such a model, and through an analysis of the artifacts generated to see where the model has succeeded and where it has fallen short. Finally, there is the potential for the formalization of game aesthetics to drive new human thinking about games and play experiences, through a continued attempt to create that which cannot be formalized.

2. THEORIES OF GAME DESIGN

Many theories of game design take a rules-centric view. Among Juul's criteria for defining a game is that they are rule-based and that they have a valorized outcome [14], Salen & Zimmerman argue that games require an "artificial conflict" that is defined in part by the game rules [20], Flanagan speaks on the importance of explicitly designing rule systems to convey the intended message of the game [11]. Practitioners also define games in terms of their rule systems, with Costikyan defining a game as goal-oriented requiring player decision-making[1], Crawford as a entertaining plaything with challenge and conflict[2], and Meier famously described games as a "series of interesting choices" [19]. Sicart disparagingly summarizes the "proceduralist" position as holding to the belief that "a game means what the rules mean, and understanding what games are is to understand what their rules describe" [21], to the exclusion of considering the personal nature of play and how players might interpret those rules.

This shared understanding of rules as a core element of a game, as what distinguishes a game from a toy or plaything, has led to many games scholars investigating "Formal Abstract Design Tools": formal methods for describing and analyzing game systems [3]. Formal representations for game rules include qualitative approaches such as design patterns [1], abstracted representations of mechanics [9], and representations for how players learn concepts via mechanics[3]. These systems all focus on game mechanics as the core of a game, and separate out the rules of a game as something that can be studied and understood in isolation of the rest of the game's design.

The MDA framework attempts to bridge the divide between mechanics and aesthetics [13], offering an analytical lens as well as a design process that can map from a desired emotional response in players or aesthetic aim of a game to the rules that produce it. It breaks down games into three components - Mechanics (the data and algorithms that define the systems of the game), Dynamics (the behaviour resulting from a combination of the game's mechanics and the player's input) and Aesthetics (the emotional responses evoked in the player by the game). However, even MDA is still focused on the production of games as a set of rules, rather than a collection of carefully crafted game assets: rules, yes, but also art, music, sound effects, and spatial design that coalesce into a playable experience. Missing from all these formal models of a game is some acknowledgement of the craft of game design outside of its rule system.

[1]http://www.costik.com/nowords.html
[2]http://tinyurl.com/crawfordgame
[3]http://tinyurl.com/gamedevchem

3. AUTOMATED GAME DESIGN

The idea of using software to automatically design or redesign games is a popular recent trend in artificial intelligence and games research. In [22], the authors say of game generation: "rules are arguably the core feature of a game, and for an algorithm to generate a game it needs to generate the rules in some form... Generating a complete game would typically mean generating *at least* the rules of the game." In this section we summarise work in the field, and show how this philosophy is evident throughout current work on AGD.

[15] describes a system which takes noun-verb pairs and matches them with a database of mechanics, art assets and a knowledge base. An input like {*pheasant, shoot*} can render as a game about shooting birds or about avoiding being shot as a bird. Connecting verbs with relevant mechanics is a key focus of the work, if not the central objective.

Browne's work in combinatorial boardgame generation is also important in non-digital AGD [2]. Browne's *Ludi* system generated abstract combinatorial games, which consisted entirely of their ruleset: they have no surface-level meaning, theming or any content besides its ruleset. The most famous example of Ludi's output is the game Yavalath, which was sold commercially and met with critical acclaim[4].

In [23] the authors propose an AGD system which designs rulesets for simple realtime arcade games. The AGD system focuses primarily on the game's rulesets and evaluates the quality of the resulting games based on how well neural networks learn strategies for each set of game rules. The paper discusses rules explicitly in introducing the work: "*...the very heart of every game, that which defines the game: its rules.*" The authors go on to state that they "*take a fairly liberal and inclusive view of what constitutes rules for a game*" although add that their system "*will err on the side of exclusiveness and adopt a stricter view of what constitutes a rule*". The notion of a score is incorporated into the generated game's rulesets; the player wins a generated game by meeting a score limit within an allotted time.

In [24] the authors introduce the Game-o-Matic, presented as a mixed-initiative tool but fundamentally an AGD system which takes in simple inputs from a user to describe a map of relationships between concepts that the system will then go on to express. Treanor et al use the concept of *micro-rhetorics*, small self-contained mechanics which can be combined together and tweaked to form larger game systems. Although the system can later add on visual elements to theme the game, the primary focus of the system is on a coherent set of rules which convey some of the meaning of the original conceptual graph the system was provided with. This is in-keeping with the philosophy of proceduralism that the system partly is built upon, in which meaning in games is expressed through the interactions between systems of rules.

Finally, *ANGELINA* is another AGD system which, similar to the Game-o-Matic, begins with some input from a user (in this case the input is less prescriptive, such as a word or phrase) and then produces a game as output [8]. There are

[4]http://www.cameronius.com/games/yavalath/

many iterations of *ANGELINA* but all versions have at least one component of the system which focuses on rules or game mechanics. Although the system puts a heavy emphasis on the thematic elements of the game's design, mechanics are often the focal point of the system (with the exception of the most recent iteration of the system, *ANGELINA*[5]). As an example, *ANGELINA*[1] designs simple arcade games with scoring mechanisms and simple collision-based rulesets [7], using a domain based on the one described in [23].

The above does not represent an exhaustive coverage of AGD research, but it does touch upon the projects which are most prominently identified by their authors as AGD systems. These systems often differ in their target genre or the underlying design of their generative systems. However, all of the AGD systems we have described in this section produce games with the following features: they produce games with a defined *win state*; they produce games with a scoring mechanism; they include a notion of difficulty or challenge (with the exception of [15]).

These features are archetypal videogame concepts, but only for a very narrow and traditional sense of the word videogame. In particular, it appeals to a particular stereotype of videogames as objective-driven tests of skill in pursuit of a goal of some kind, where a player's performance can be quantified and compared against others, and there is an objective measure of success to be later reflected upon. While this is clearly true for many videogames, it narrows the space of games considered by AGD research.

4. COMPUTATIONAL CREATIVITY & AGD

Computational creativity is a rapidly expanding subfield of artificial intelligence that concerns itself with building systems which 'exhibit behaviours that unbiased observers would deem to be creative' [6]. This research stretches from creativity in mathematical endeavours [4] through to classically creative domain such as music composition [10] or narrative [17]. Computational creativity research influenced the development of *ANGELINA* over many iterations of the software, leading to us incorporating visual theming into the system's design, as well as the generation of commentaries and other 'framing information' [5] that strengthens the perception of the software as being creative.

In [10], the authors describe the problems tackled by Computational Creativity as being different from traditional artificial intelligence problems. 'Computational creativity is faced with the dilemma that, while creative behavior is intelligent behavior, notions of optimality are not defined.' AGD overlaps greatly with Computational Creativity for this reason - 'fun' cannot be optimised or easily defined, and many of the decisions made in designing a game are highly subjective and difficult to quantify. Even the purest, most mechanics-driven games such as the simple puzzle game *Threes* still contain complicated aesthetic decisions to present the game in a particular way, to make the player feel a certain way as they interact with the game, or even to communicate the mechanics of the game clearly.

Computational Creativity also concerns itself with building assistive as well as autonomous software - that is, software which can work with a user to enhance their creativity, at both expert and novice levels. In order to build complex game design tools that can provide assistance and guidance to game developers, we need to research systems which understand the totality of game development, and are thus able to comment on one aspect of a game with an understanding and an appreciation for how it interacts with every other part of the game design, in both mechanical, dynamic and aesthetic terms. Without building software that can engage with these complex ideas, for which notions of optimality don't exist, we aren't really building automated game designers - we're building automated rule makers.

5. ANGELINA 6 - A DESIGN SKETCH

In a 2014 article, *Screw Your Walking Simulators*[5], writer and critic Joel Goodwin considers the use and misuse of the term *walking simulator* to describe a particular class of games deemed to be not sufficiently *game-like* by a large section of the games community. The term has mostly been co-opted by people making such games, but Goodwin believes this to be unproductive, even in protest. Instead, he proposes the term *himitsu-bako*, a Japanese word used to describe a kind of toy box which can only be opened by solving a series of interactions or puzzles. To quote Goodwin: "*...a direct translation is 'secret box" which puts the emphasis on the secret at the heart of the box... I think that* ***secret box*** *is a much better analogy for a broad swathe of games that eschew challenge in favour of pursuit of a little secret, the little magic a developer wants to share with you.*"

The class of games described by the term *secret box* are very varied and common features are hard to discern. We consider the term to encompass any game in which the player explores an environment looking to reveal something, whether that be a system, a story or visual/aural content. They range from very abstract and limited-interactivity experiences, such as *Secret Habitat*[6], through to more traditional narrative-led puzzles games like *Gone Home*[7]. The main connecting theme the games share seems to simply be that part of the game can only be experienced through interaction or exploration – that there is some kind of secret experience to be found within, no matter how small, that the player can look for. Note that we are not looking to concretely define the term here, or draw boundaries between one type of game or another. Instead, we cite it here as a concept which is guiding the design of a new AGD system.

ANGELINA is an automated game design system that creates videogames through an orchestrated process of information gathering, content generation and process framing/commentary. There have been many different versions of *ANGELINA* built to tackle different aspects of the game development process, as well as explore a variety of different game genres and platforms, including newsgames, puzzle-platformers, and 3D maze games. Every iteration of *ANGELINA* so far has included a component for generating and evaluating game mechanics or game rulesets.

ANGELINA[6] is a new iteration of *ANGELINA* which is being built to design secret box games. The overall aim of the project is to create a system which can build games in which the player explores a 3D world and can discover its contents. The world may have interactive elements or elements that respond to the player's presence, but this is not a requirement. Instead, the focus of the system will be on designing worlds with a defined mood and atmosphere, designed to evoke specific emotions or feelings, with an em-

[5] www.electrondance.com/screw-your-walking-simulators/
[6] 2014, Strangethink, strangethink.itch.io/secret-habitat
[7] 2013, The Fullbright Company, gonehomegame.com

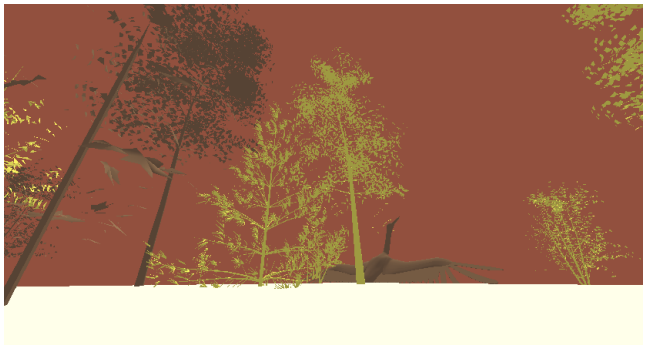

Figure 1: A screenshot from *Forest I* by the current version of *ANGELINA*[6].

Figure 2: A screenshot from *Weird Forest*, a game in our inspiring set for *ANGELINA*[6], designed by KO-OP MODE as a tutorial for game development.

phasis on the layout and design of the world space to guide the player's movement and experience.

Development of versions of *ANGELINA* often involve the construction of what Ritchie calls an *inspiring set* [18]; a set of example artefacts that will hopefully be in the generative space of the finished system. An example of a simple secret box that is in our inspiring set for *ANGELINA*[6] is *Weird Forest*[8], a simple game project used as a tutorial for teaching the Unity game development tool. The player starts on a stone path surrounded by trees and ferns, with leaves and dust falling from the sky. The horizon is blocked off by billowing clouds. The player can walk through the forest or follow the path, which leads them to a ruined castle folly and a partially ruined stone wall. The game is very small but provides a consistent and pleasant atmosphere, and hides content like the castle for the player to discover. Figure 2 shows a screenshot from the game, and figure 1 shows a screenshot from a prototype version of *ANGELINA*[6] with the input 'Forest'.

Previous iterations of *ANGELINA* operated as follows: a *predesign* phase proceeded to decide on theming for the game, collecting art and audio assets and finalising the overall art direction for the game. Then, several generative processes would design different elements of the game. These elements typically included 'level design' (the physical geometry of the world) and 'ruleset design' (the mechanics of gameplay and the player's objective), as well as other elements which varied according to the type of game being generated. Some versions of *ANGELINA* included a *postdesign* phase which cleaned up the game design and created commentaries and framing texts that described the development process and creative decisions.

With *ANGELINA*[6], we are shifting the focus of the games developed by our system from skill-based challenges to a focus on exploration, discovery and sensory experience. This means that *ANGELINA*[6] will not have a generative process for creating rulesets, and its games will not have a completion requirement, a score, or a failure state. Instead, we will be focusing on the design of spaces to fit a theme: either a mood (such as 'happy') or a location (such as 'a forest'). This will involve a predesign phase, as before, to expand the given theme and gain additional contextual information. However, this phase will be extended to last throughout the content generation and evaluation phases, so that *ANGELINA*[6]'s understanding of the theme can develop in response to playtesting with human players.

ANGELINA[6] will generate placements of objects which it collects and selects to create a scene out of. These objects will have their position, scaling, colorisation and quantity determined by *ANGELINA*[6] as it tries to understand the theme and what kinds of objects would be appropriate in the space it is trying to create. We are exploring ideas from 3D level design, as well as architectural ideas [12], to take into account ideas like lighting, sight lines, and how to encourage the player to explore certain areas. We will also be building in the use of music and sound effects, and building a system to appropriately place them within the world.

Evaluation of these ideas is difficult. One of the appealing features of skill-based challenge as a game design aesthetic is that completability is usually easily quantifiable, and since conventional NPC AI is well-suited to classic game challenges, AGD systems can normally model the player using AI agents and evaluate rule execution, score limits and level success. In the case of *ANGELINA*[6], our aims are to create games with a different kind of experience, and as such they require a different kind of evaluation. We hope to achieve this through a combination of automated playtesting with people, and creative criticism software, such as DARCI [16].

Our overall evaluation will rest on whether intended combinations of atmosphere and emotion can be evoked in players. *ANGELINA*[6] will assess this by conducting playtests across an extended design process, which will involve periods where *ANGELINA*[6] stops running altogether, possibly for a number of days, to give playtesters time to provide feedback to the system. These playtests will assess, among other things, how players explore the world and where they spend their time, as well as directly questioning playtesters afterwards through question-and-answer forms. We intent for *ANGELINA*[6] to also conduct similar playtests after release to assess how successful it was in achieving its aims.

A focus on atmosphere and place with *ANGELINA*[6] is an end in and of itself, but it also provides potential for further systems to be built on top of it, enhancing certain aspects of the secret box concept and also moving towards other spaces of game already explored by existing AGD approaches. For example, *Kairo*[9] has been popularly tagged as a 'walking simulator' on the Steam marketplace. The game puts a large focus on atmosphere and the feeling of inhabit-

[8]2014, KO-OP MODE, workshops.ko-opmode.com

[9]2013, Richard Perrin, kairo.lockeddoorpuzzle.com

ing a strange world, but also contains many puzzles for the player to solve, mostly based around navigating the game's spaces in a particular way. Exploring how to add puzzles to carefully-designed spaces like the ones *ANGELINA*[6] is targeting is an interesting direction to split off into.

6. CONCLUSIONS

We have argued that the emerging field of automated game design is currently focused on a narrow definition of the word game, one which assumes the presence of objective notions of success and progress and is extremely goal-oriented. We proposed that this is potentially founding the field on too conservative ground, and that the notion of what a game means for AGD should be kept as broad as possible in order to embrace notions of play and the more broad and nuanced definitions of the word game.

In pursuit of this broader remit for AGD, we discussed the term *secret box*, coined by Joel Goodwin, to describe a class of games which are primarily focused on exploration, discovery and the evocation of mood. We proposed a new version of the *ANGELINA* game design system, *ANGELINA*[6], which is designed to produce secret box games and focus on areas of AGD that are less rules-centric. We argued the benefits of this approach include a broader and more varied AGD community, as well as providing new lenses through which to examine automating game design.

The games industry is growing, maturing and diversifying year on year, but many areas of academic research are still hung up on antiquated notions of what a game is, who games are for, and why games are made. AGD is one of the bravest new frontiers for games research, and we should meet that challenge by providing a suitably ambitious and brave approach to our conception of what games are, and what they can be. The result can only be better research, better systems, and better games produced as a result.

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