What is a Quest?

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Abstract

Quests are a common way for games to add content into their experiences. For this reason, procedural generation of quests has become a popular area of research in recent years. However, in academia there is no consensus on the definition of a quest, despite many researchers attempting to generate them. The purpose of this paper is to do a literature survey of quest definitions in the context of procedural quest generation, and synthesize the different versions into a more general definition that encompasses existing definitions.

1 Introduction

The concept of a quest is inherently tied to Role Playing Games (RPGs) due to the quest-driven story model (Tomai, Salazar, and Salinas 2012). For example, the quests in the RPG Skyrim (Bethesda 2011) drive all of the game play for both the main story and optional adventures that the player can engage with in "side" quests. However, quests also exist within games that are not RPGs (Ashmore and Nitsche 2007), such as in Animal Crossing: New Horizons (Nintendo 2020) where the player can optionally interact with the quests provided by the Nook Miles and Nook Miles+ systems. When talking about procedural quest generation, most research papers focus on quests generally as a game play piece within a game, and do not limit the research to RPGs. The definition of a quest should therefore be applicable to all genres of games, and not be limited to RPGs or other RPG-like games.

Quest generation research shares close ties to story generation research due to the narrative aspect often associated with a quest. However a narrative is not a required element of a quest for it to be functional. For example, the daily quest system common in Massive Multiplayer Online RPGs (MMORPGs) provides quests that do not contain any narrative elements, and instead propose challenges for the player to complete with the various game mechanics. Because a quest is not just the narrative, but also includes this notion of actions for the player to perform within the game, the definitions that are used in story generation may be inadequate

for some cases of quest generation research. Individual definitions borrowed from narrative generation research could suit the purposes of a single paper, but would be improper to use for broader research efforts.

Soares de Lima, Feijo, and Furtado (2019) summarize the problem by stating that "[...] differently from the well-established theory about quests in literature, there is no general quest theory in computer games [...]". Though this paper was able to identify this problem, the paper does not attempt to address the issue and instead offers a new version of a quest definition. A full established theory of quests in video games would include a definition of a quest, but the full theory is not necessary to produce effective quest generation systems. Multiple approaches have led to individual success in the field, but without a consensus among researchers interested in this topic, new work is prevented from building on previous work. This can affect the quality of new research being done in the field, because the new research can be difficult to compare to work that has previously been done, and can be difficult to reproduce.

As we will demonstrate, most papers create a definition of a quest that suits the need of the research being done. This creates two main problems. The first problem is that it creates a high barrier of entry to the field. If a new researcher wants to add to the field, they have to either create a new definition or choose a definition from a large pool of options. If the author chooses to create a new definition then it further exacerbates the existing problems, and if the author decides to choose a definition from existing ones then it can be a difficult choice. The author has to evaluate each definition in the context of the planned work, which creates a high level of work that needs to be done before the new quest generation system can even be implemented. The second problem is that it becomes difficult to compare different quest generation approaches. The definition of a quest that one generation system relies on can have completely different requirements or properties to another definition. If one generation system requires that a quest contains a narrative element and another does not, it is challenging to say whether one approach is better than the other because the outputs are fundamentally different. These two problems together compound into another issue, where not every paper that discusses quest research even defines a quest. Instead, some papers opt to talk about the effects or uses of quests

within the game, because there is no agreed upon definition of a quest to reference. For these reasons, the purpose of this paper is to perform a survey of the quest definitions currently proposed in procedural quest generation research. As a workshop paper, we hope to further the discussion for a unified quest definition and encourage more communication in this field by combining the existing definitions into a single generic quest definition.

2 Background

There are many areas of research which have defined quests. There has been an effort to create a unified quest theory for video games (Aarseth 2005, Doran and Parberry 2010), with Howard (2006) synthesizing a few proposed definitions into one. Generally this research analyzes quests that are found in various games to identify design patterns or archetypes that are present in quests. The definition of a quest is also used in personalization research, where the goal of the systems are to provide the player with a unique, optimal experience (Vanhatupa 2011, Thue 2007). Quests are also often discussed in interactive narrative research, because quests are often the vehicle through which video games tell a story. This field provides their own options for the definition of a quest, which have more of a narrative focus (Carmichael and Mould 2014). Given the emphasis on narrative, the quest definitions provided by the interactive narrative research are typically inadequate to accommodate quests that do not include narrative elements. In traditional literature such as books, the quest has been analyzed only in its narrative context, because there is no interactivity (Propp 1968).

Understanding video games using the mechanics, dynamics, aesthetics (MDA) framework in the context of quests provides a foundational understanding of how a quest is represented in a game (Hunicke, LeBlanc, and Zubek 2004). The player inputs specific sequences of button presses, directional information from a control stick, or other information from a controller that produces changes to the game state. These changes to the game state can be as simple as the player moving a set distance from their current location, to complex changes such as executing a preset attack with a single button. These changes to the current state aggregate to form the game mechanics. One or more game mechanics can be considered to be an action that can be taken within the game, and these actions are used to complete a quest. The player knows how to finish a quest through visual or audio cues provided by the game.

The presentation of a video game refers to all of the components of a video game that the player has within the game to help them understand the game. Presentation serves as the interface between the player and the game, and helps the player gain more information about the video game world (Ignacio 2013). The interface can include elements that are common to most games, such as health, or elements that are unique to a specific game such as icons for player abilities.

There are two main places where the presentation gets used in the context of quests: a heads up display (HUD) and a menu. The HUD is a common way to include UI elements within a game which will provide player information about metrics such as health. This is usually where information about a player's current goal is found, to serve both as instructions for the player and a reminder of how to progress in the game. This is how, for instance, Dragon Age: Inquisition (BioWare, Electronic Arts 2014) presents their quests to the player. The other place that the information for a quest can be found is in a menu, such as in The Legend of Zelda: Breath of the Wild (Nintendo 2017).

3 Methodology

The methodology for this survey is based off of the review process commonly used in software engineering literature reviews (Kitchenham 2004). This survey was done using a manual search of the FDG, AIIDE, and DiGRA conferences, and included any paper that was explicitly researching procedural quest generation. Additionally, a google scholar search of "procedural quest generation" return 92,900 results. From there, only published academic papers were considered. These two methods produced 20 potential papers that researched how to procedurally generate a quest. Four papers without a formal mathematical definition were omitted (Khaliq and Watson 2018, Chongmesuk and Kotrajaras 2019, Kybartas and Verbrugge 2014, Sullivan et al. 2012).

4 Proposed Quest Definitions

Table 1 shows the definitions of quests proposed by different papers. The definitions were analyzed for their similarities and differences, and a labeling system was designed from the common ideas present in the definitions. Each label in order to a specific property that the definition could have. "T" refers to a definition that contains the concept of a task, action or goal that must be completed. "R" refers to a definition that includes a reward. "P" refers to the requirement that the player must complete the quest. "O" refers to the idea that the tasks must be completed in some order. "C" refers to definitions that include the concept of progression. "N" refers to definitions that include narrative elements, and "E" refers to definitions that are specifically tailored to meet the needs of their quest generation system.

Notably, only one paper cited another work in their definition of a quest, NC1, while the rest of the papers offered their own definition of a quest. NC1 cites a paper that analyzes the personalization effects of the player character in MMORPGs (Tychsen, Tosca, and Drachen 2006). The cited paper belongs to the body of research that focuses on personalization of the player experience.

4.1 Tasks, Actions and Goals

The most common idea from all of the definitions is the notion that there individual pieces that must be completed. These are most commonly called tasks, as in TP1, TR2, TNR1, and TPN1. They are also referred to as actions in TRNO1 and TEO3. One definition, TN1, refers to this simply as a single goal, while TR1 and TEO1 refer to a set of goals. Additionally, TP2 calls them "quest points".

"Task" provides a generic way of dividing a quest into individual pieces, which suggests that each part of the quest needs to be completed. "Action" implies that there has to be some initiative from the player in order to complete the

Label	Citation	Definition
TR1	(Doran and Parberry 2011)	A quest is a player task commonly found within role playing games where the player is challenged to complete goals in return for some reward.
TR2	(Li and Riedl 2010)	We represent quests as decomposition recipes [...] Quests are decomposed into a task and an award [...]
TP1	(Hromada et al. 2015)	Quest, in this context, is a task the player has to fulfill, usually assigned to the player by an NPC.
TP2	(Trenton et al. 2010)	A quest is a single mission that the PC can or must complete and is divided into quest points.
TN1	(Ashmore and Nitsche 2007)	Together these coalesce into four core elements that are the framework for understanding and defining quests in a virtual world: The setting, the space, the challenge, and the goal.
TNR1	(Tomai and Salazar 2012)	These quests specify task requirements (e.g. kill 10 rats) and rewards (e.g. progress points and a shiny hat), and provide narrative text intended to situate and motivate the task (e.g. help us, the rats are eating all our food!).
TPN1	(Soares de Lima, Feijo, and Furtado 2019)	In this paper, we consider that quest is defined by a set of tasks to be accomplished by the player (e.g. gathering and delivering items, killing enemies, protecting and saving characters).This set of tasks represents the plot of the quest (i.e. storyline).
TRNO1	(Breault, Ouellet, and Davies 2018)	A quest is a set of actions that must be performed in order to achieve a certain goal, usually for a reward. They [...] are embedded in a piece of narrative that makes the sequence of actions make sense given the NPC and the current world state.
TNCPR1	(Santos and Ramalho 2012)	A characteristic of the genre is a focus on character progression and open ended narratives by means of quests, which represent tasks assigned to the players in exchange for in-game rewards.
NC1	(Lee and Cho 2012)	A quest is a storytelling mechanism by encouraging players to interact with non-player characters and allowing them to observe dramatic events as the game progresses. [...] [Tychsen et al. 2006].
N1	(Onuczko 2007)	Each quest is a small story that focuses on a small subset of NPCs, NPC interactions, and settings found in the story.
C1	(Alexander and Martens 2017)	In this work, we adopt a simplified notion of quest meaning, essentially, a subset of the nodes in a game play trace that are recognized by the game system as progress(e.g. with "achievement" messages).
EO1	(Soares de Lima, Feijó, and Furtado 2014)	We define a quest as a planning problem, whose statement is the following tuple: $Q = \langle P, O, S_0, H_g \rangle$
E2	(Pita, Magerko, and Brodie 2007)	The interactions between objects used in TRUE STORY were earlier defined as quests.
TEO3	(Stocker and Alvin 2018)	A quest is an acyclic action hypergraph $H_A(N, E)$.

Table 1: Definition of a quest as proposed by different papers

current section of the quest. "Goal" has a slightly different connotation to it, because goals can be short or long term. A short term goal for the player could be to complete the current quest, and a long term goal could be to finish the game. Because goal has a dual nature where it can be used to describe both small sections and large chunks of a game, it would be inappropriate to confine the word "goal" to a single quest. Instead, "goal" should be reserved to describe other game play aspects, and should not be required as part of a quest. This last wording of "quest points" is the most unique way of dividing a quest into different sections, and is functionally the same as the word "task" because they both divide a quest into completable sections.

In order to fully understand the relationship between tasks and actions as defined in these papers, the definitions that the papers provide for a task or action is examined. TPN1 and TNR1 provide examples of what a task should be, and describe them as high level objectives that are not rooted in exact game mechanics or game inputs. Actions, in the context of TRNO1 and TEO3, refer to high level concepts that are executed by the player, and not specific game mechanics. TEO3 bridges the gap by proposing that a task should be the actions that a player can do within the game. There is sometimes a notion of challenge associated with these tasks,

with TR2 and TN2, but challenge is also ambiguously defined and can vary highly between players.

4.2 Reward and Progression

Many of these definitions include the idea of a reward: TR1, TR2, TR3, TNR1, TRNO1 and TNCPR1. However, there is no consensus between definitions of what a reward is. Rewards are often thought of as in-game items such as currency, but the precise language of what a reward can be has less impact on the understanding of a quest than the precise definition of a task because the reward doesn't have to be completable by the player. Progression is also a common theme, and is present in definitions TNCPR1, C1, and NC1. Progress includes things like experience points which allow for a player to increase in level, or skill points which allows them to unlock new skills in a skill tree. Progress could also be the ability to play the next quest in the game or to unlock a new area of the game that the player was previously unable to access. Progress can be labeled as a reward, so these can be viewed as subset of the definitions that include reward.

4.3 Ordering

There are a few papers that include the idea of order associated with the tasks that must be completed TRNO1, EO1 and

TEO3. The kind of ordering varies by definition. TRNO1 proposes that an ordering exists, but fail to specify the kind of ordering. EO1 proposes a total ordering as described in the planning problem, and TEO3 proposes a partial ordering in their definition of the hypergraph. The ordering of the tasks usually refers to how the player completes the quest. This varies between games due to the way that the tasks are presented to the player. Sometimes, all of the tasks in a quest are presented to the player at the same time, and other times the tasks are given one at a time as the player completes them. In the first case, the ordering of tasks is decided by the player, and in the second case the ordering is decided by the game. A partial ordering accommodates the first case, because there are one or more tasks that can be completed in any order, and a total order occurs in the second case because each task has to be completed in a specific order. However, both cases can be described as a partial ordering because a total order is a special case of a partial ordering.

4.4 Narrative

Seven of the quest definitions require that the quest contains narrative elements: TN1, TNR1, TPN1, TRNO1, TNCPR1, NC1, N1. Soares de Lima, Feijo, and Furtado (2019) define quests in traditional literature as a journey toward a specific goal where multiple adventures can occur, which cites the body of work analyzing quests only for their narrative content (Propp 1968). In this context, the quest is only valued for its narrative potential. N1 only uses narrative content as the requirement for a quest, but the lack of defined tasks makes it difficult to reason with this definition of a quest. TN1 includes elements such as the setting and space in their definition, which refers to the narrative elements of world building and the current storyline.

The use of the word narrative in the context of video games can mean both explicit and sifted narrative. Explicit narrative refers to a story that a designer writes, that is now being conveyed to the player through the medium of the video game. Sifted narrative refers to the stories that the player community applies to game elements that don't inherently have explicit narrative (Kreminski, Dickinson, and Wardrip-Fruin 2019). These stories are told between members of the community using the game's mechanics or dynamics as the backbone of the narrative, and the details are filled in by a player in the community. The sifted narrative is part of the aesthetic as defined by the MDA framework.

Narrative content could also fall under the category of reward, where if a player completes a quest they are rewarded with the next piece of the story. For that reason, these quests can also be viewed as a subset of the quests that require a reward as part of their definition. Narrative rewards would include game play elements such as a cutscene playing after a quest is completed, or a new dialogue that an NPC says.

4.5 Player

There are a few quest definitions that explicitly describe that the quest must be completed by the player: TP1, TP2, and TNCPR1. This is an important distinction, because quests are meant to be for the player, and only the player. A quest is added to a game by a designer for a specific purpose. These quests allow the designer to highlight specific mechanics, lead the player through a story, or otherwise interact with the game world. The quest then becomes the way for the designer to communicate with the player. NPCs can have the ability to complete a quest, but they can only do so when the player allows the NPC to complete the quest.

There are some games, such as Pokémon Sword and Pokémon Shield (Game Freak, The Pokémon Company, Nintendo 2019), where the NPCs are allowed to go on a quest. In these games, each individual pokémon (NPC) has a level associated with it, and one of the ways that a player can increase the level of the pokémon is by leaving the pokémon at the daycare center. The pokémon will receive experience points while they are at the daycare center, which allows the pokémon to gain levels. This gameplay piece can be thought of as a quest, where the pokémon is assigned the quest of going to the daycare. However, the pokémon can only go on that quest when the player deems it appropriate, and the pokémon is not allowed to complete the quest independent of the player. The assignment of quests to NPCs within a game can be thought of as a game mechanic, which means that a player could receive a quest where the task is to provide a quest to an NPC.

4.6 Specificity

TEO1, E2, and TEO3 are specific definitions specialized to work within the context of their respective quest generation system. TEO1 proposes that a quest should be a planning problem $Q = \langle P, O, S_0, H_g \rangle$, where P is the set of predicates that are used to define the game state, O is the set of planning operators, S_0 is the current game state, and H_g is the totally ordered set of goals. This definition creates two issues due to its requirement that the quest is a planning problem. The first is the issue of generality, because only quest generation systems that can solve a planning problem can use this definition of a quest. A planning problem can be solved using a planning algorithm. However, any proposed quest generation system that is not a planning or planning-like algorithm cannot use this definition. One quest generation system uses simulation to generate a quest, (Breault, Ouellet, and Davies 2018), which incompatible with definition TEO1. TEO1 also poses the additional issue of presentation to the player. A game would never show the planning problem to the player and ask the player to solve the plan in order to receive the quest. The solution to the planning problem may be presented to a player in some way, but the planning problem is not what is shown to the player.

E2 defines their quest as something that is generated from their quest generation system. The quest generation system is made up of constraints on the memory what happened in previous game states, attributes which encompass the player's ability to complete the quest, actions that the player is allowed to take within the game, layers which define the interaction between the object and the current game state, and proximity, which refers to the closeness of objects to each other. While none of these components are inherently problematic, defining a quest in this way implies that no other information could be part of a quest. Most notably, this definition omits the idea of a reward which is a common

requirement of other quest definitions.

Paper TEO3 proposes that a quest is a cyclic action hypergraph $H_A(N, E)$ where N is the set of nodes and each node is a possible action, and E is the set of directed edges where each edge is labeled true or false. A hyperedge in this graph is when a successor node has more than one predecessor nodes. Practically, this paper defines a valid quest to be a directed acyclic hypergraph with a single sink node acting as the final action of the quest. This quest definition has the same two issues as TEO1. On the first issue of generality, this definition requires that the quest generation approach has to generate a specific directed hypergraph. Generation approaches that cannot output this specific hypergraph cannot use this definition of a quest. For example, there is a proposed quest system that uses a genetic algorithm to generate a quest (Soares de Lima, Feijo, and Furtado 2019), which does not rely on a graph traversal algorithm. This proposed quest generation system is incompatible with TEO3, because the generation system is incapable of generating a directed hypergraph. The second issue is the presentation of the quest. The player would not be presented with the complex hypergraph structure, and then asked to interpret the structure in order to complete the quest. The player might be presented with some pieces of the graph, such as the instructions for how to complete a possible action in the graph, but the full graph would always be hidden from the player.

5 Combined Quest Definition

These quest definitions can be combined into a single generic quest definition. The new definition attempts to encompass all of the information that is captured in section 3 in the most generic way.

Tasks, actions, goals, rewards, progression, narrative, order and player are all identified as having commonality between different proposed definitions, and are considered to be essential elements of a quest. For that reason, the individual components were generalized into the least amount of requirements to be a part of a quest. Progression and narrative can be viewed as reward, so these ideas were combined into the single component of reward. Tasks, actions and goals have to be more carefully combined. An action implies that there is exactly one thing for a player to do using the game mechanics. Some tasks in a quest require a player to complete multiple actions. For example, a task that a player could receive would be to talk to an NPC in a different location, which would require two actions, one for moving to the location, and one for talking to the NPC. For this reason, the tasks can encompass actions, where a task can be completed by one or more actions. As discussed in section 4.1, goals can refer to long term objectives for the player such as finishing the game, which would require the player to complete all of the main quests. The word "goal" therefore has the potential to include multiple quests within it, and would not be suitable to describe part of a quest. Therefore, the word "task" is chosen over the word goal, in order to reserve that word to refer to other aspects of the game.

The elements in EO1, E2, and TEO3, are considered to be non-essential because they introduced concepts that are too specific to be used in a broader context. EO1 required that

the quest be a planning problem, E2 required that the quest be a something generated from the quest system outlined in the same paper, and TEO3 required that the quest be a hypergraph. Because these definitions are so specific, they limit the kinds of approaches that can be used to generate a quest. These components were omitted to allow for any approach to be tried in future quest generation research.

In addition to the ideas expressed in the definitions, gaps in this body of work were identified. These definitions lack a discussion of what a task is and lack a connection to the presentation of the quest to the player. A task needs to be defined so it specifically relates to the game mechanics, and needs to be more precisely defined in how to complete a task. The presentation of quest affects the player's ability to interact with the quest, and should also be considered an integral part of the quest.

Definition 1 *A quest $Q = \langle T, \leq, R \rangle$ is a partially ordered set of tasks T that the player must complete to get one or more rewards from a set R.*

$\leq$ defines the partial ordering on the set of tasks, and is created based off of the in-game logic.

Definition 2 *A reward $r \in \boldsymbol{R}$ is an in-game item, narrative elements, or progression elements.*

The set $\boldsymbol{R}$ contains any rewards that the developer wants the player to receive in exchange for completing a task within the quest. The rewards for an individual quest R come from the pool of possible rewards $\boldsymbol{R}$. Rewards can be in-game items can be things like currency, a new weapon or other items that allow the player to interact with the game. Narrative elements can be things like cut-scenes, or new dialogue offered by NPCs which help the player understand the story of the game. Progression elements would include things like experience points which would allow a player to increase in level, or progression points that a player would use to unlock new abilities in a progression tree. All of the possible rewards for the player are aggregated in the set R, but the specifics of when and how the rewards are assigned to the player will be assigned at the task level in the description that follows.

Definition 3 *A task $t \in T$ is a 4-tuple $\langle C, M, I, R_t \rangle$, where C is the condition that must be made true in order to complete the task, M is the system that monitors the sub-section of the game state that is required to make C true, I is the presentation of the quest, and $R_t \subseteq R$ is the set of rewards that is given to the player when C is true.*

A task t is completed by the player interacting with the game mechanics, which necessitates C as a functional check for whether t is completed or not. This definition proposes a monitoring system M to determine whether C becomes true, which allows for any representation of a game state. As the player completes actions using the game mechanics, the game state will be affected in specific ways. M can check the ways that the game is expected to change in order to measure whether the player has completed the action or not. For example, assume the player is given a task to go to location A. In order to complete this task, the player is allowed to go to any part of the area within location A, not just a specific pixel. M is the monitoring system which determines

whether the player is within the area of location A, which includes many different specific coordinates as a possible way to satisfy this requirement. Because there is no requirement for which game mechanics the player interacts with in order to make C true, the player is allowed to choose which mechanics to interact with to satisfy C. When C becomes true, the task is considered completed and the player is presented with the reward R_t, and is optionally presented with the next task in T depending on if the player completed the final task or not.

I is the presentation to the player through various in-game elements that help the player complete the task or situate the quest within the narrative, such as written instructions, markers on a map, or highlighted objects. The presentation clues the player into which mechanics must be used in order to make C true. The presentation is included at the task level because the presentation can vary between tasks that are a part of the same quest. For example, a player might complete a task where the presentation marks a location on a map, and the next task is simply shown to the player as text. I can also optionally include the motivations of why the player should complete the quest according to the game's internal logic, as suggested by TNR1.

Rewards R_t are also included at the task level in order to specifically define when a player receives rewards. Because progression and narrative are considered a reward, it becomes necessary to define rewards at the task level as well. For example, a player could complete the first task in a quest, which would trigger a cutscene. That cutscene needs to be specifically associated with the task, because that is when the player receives that reward. If all of the rewards are presented to the player at the end of a quest, then the rewards simply need to be associated with the final task of the quest.

6 Comparison of Quest Definitions

In this section, the applicability of one of the quest definitions, TR1, is compared to the new definition proposed in this paper. Animal Crossing: New Horizons was chosen because its quest systems offer an alternative perspective where the quest does not have to include narrative elements. Animal Crossing: New Horizons has two quest systems: Nook Miles and Nook Miles+. Nook Miles are quests that include long-term goals such as catching 100 fish, while the Nook Miles+ system includes shorter term goals such as catch 5 fish. Neither of these quest systems offer narrative elements or progression as rewards, and instead reward the player with in-game items.

The Nook Miles system communicates to the player with a stamp card that gets filled as the player completes tasks within that quest. Sometimes the name of the stamp card is shown to the player, which will clue the player into what sort of challenge could be completed to fill the card. Other cards are unavailable for the player to see, and only unlock once the first challenge in the quest has been completed. From there, the player can see the progress they have made towards the next stamp in the card at any time. Each stamp card is themed to a specific game mechanic, and can only be completed once. For example, one of the stamp cards in the game requires to the player to catch fish. The player

is challenged to catch 10 fish, catch 100 fish, catch 500 fish, catch 2,000 fish, and catch 5,000 fish. Additionally, the Nook Miles system features a challenge aspect, because the system tracks your ability in each section and progressively assigns more difficult tasks. After the player completes each task, the player is rewarded with different amounts of premium in game currency, where the player gets more of the in game currency for completing the more difficult task. The player is awarded with 300, 500, 1,000, 2,000, and 5,000 in game currency respectively. In addition to the in-game currency, completing a task in this quest will also reward the player with "passport titles" which allow for additional customization. There are 5 titles: "Accomplished Lad/Lass", "Competent Fishing Fan", "Moderate Beach Bum", "Fierce Fisher", and "Battle-Tested Catch of the Day".

The Nook Miles+ system generates a set of five possible quests that are presented to the player. If a player completes one quest, then a new one will be automatically chosen and presented to the player so that there are always five quests for the player to complete. A player can choose to complete one or more of these quests in any order. The quests that are chosen from the pool of Nook Miles+ quests tend to take a much shorter amount of time to complete. For example, in the fishing category, the Nook Miles+ system presents the player with the quest to catch five fish. When a player completes one of these quests, the player is presented with different amounts of premium in game currency. For the catch 5 fish quest, the player is rewarded with 150 currency.

Each of these systems draw from different pools of possible quests for the player to complete, which reflect the game play reasons for including two quest systems. The Nook Miles system is intended for players to complete over many play sessions and incentivizes players to play the game multiple days in a row, while the Nook Miles + system provides rewards for short actions that can be completed in short time frames, and incentivizes the players to keep playing the current session. To analyze these quests in the context of different definitions, the fishing category challenges were chosen from both systems because they use the same game mechanics to complete.

Definition TR1 was used as comparison to the proposed quest definition. TR1 states that "A quest is a player task commonly found within role playing games where the player is challenged to complete goals in return for some reward". TR1 includes goals that need to be completed, and that a single reward needs to be given to the player when the goal is completed. This formalizes TR1 into $Q = \langle\{G\}, r\rangle$, where G is a set of goals and r is the reward. Using this definition, the Nook Miles quest system can be analyzed. The fishing quest is defined as $Q = \langle\{g_1, g_2, g_3, g_4, g_5 \in G\}, r\rangle$. g_1 is the first task, catch 10 fish, g_2 is catch 100 fish, g_3 is catch 500 fish, g_4 is catch 2,000 fish, and g_5 is catch 5,000 fish. The reward for this quest is tricky, because the player receives both in-game currency and passport titles but is only allowed to receive a single reward. This definition fails to fully capture the rewards available to the player in this quest. There is also no notion of the order that the tasks in G should be completed, whereas the game provides a specific order for the player. Additionally, TR1 does not include any infor-

mation about how the quest is presented to the player. The Nook Miles+ quest system can also be analyzed. The "catch five fish" quest is defined as $Q = \langle\{g_1 \in G\}, r\rangle$. g_1 is the task to catch five fish. r is the reward of 150 in-game currency. This time, the definition is able to accurately capture the main components of the quest, but there is still no information about the presentation of the quest.

Using the definition proposed in this paper, the Nook Miles fishing quest can be defined as $Q = \langle\{t_1, t_2, t_3, t_4, t_5 \in T\}, \leq, \{r_{11}, r_{12}, r_{21}, r_{22}, r_{31}, r_{32}, r_{41}, r_{42}, r_{51}, r_{52} \in R\}\rangle$. t_1 is the first task, catch 10 fish, t_2 is catch 100 fish, t_3 is catch 500 fish, t_4 is catch 2,000 fish, and t_5 is catch 5,000 fish. r_{11} is the 300 in-game currency, r_{12} is the title "Accomplished Lad/Lass", r_{21} is the 500 in-game currency, r_{22} is the title "Competent Fishing Fan", r_{31} is the 1,000 in-game currency, r_{32} is the title "Moderate Beach Bum", r_{41} is the 2,000 in-game currency, r_{42} is the title "Fierce Fisher", r_{51} is the 5,000 in-game currency, and r_{52} is the title "Battle-Tested Catch of the Day". $\leq$ is the ordering that enforce t_1 must be completed before t_2, t_2 must be completed before t_3, t_3 must be completed before t_4, and t_4 must be completed before t_5. Each task in T also needs to be explicitly defined. $t_1 = \langle C, M, I, R_{t_1}\rangle$, where C becomes true when the player catches 10 fish, and M is the system that monitors how many fish have been caught. I is the presentation of the stamp card, the indicator to let the player know how many more fish they need to catch to complete the task, and the stamp that is presented to the player when task is completed. $R_{t_1} = \{r_{11}, r_{12}\}$, the in-game currency and the title associated with the task. $t_2 = \langle C, M, I, R_{t_2}\rangle$, where C is the condition that becomes true when the player catches 100 fish, and M is the system that monitors how many fish have been caught. I is the presentation of the stamp card where the stamp first task, t_1, is presented to the player, the indicator to let the player know how many more fish they need to catch to complete the task, and the stamp that is presented to the player when the task is completed. $R_{t_2} = \{r_{21}, r_{22}\}$, the in-game currency and the title associated with the task. $t_3 = \langle C, M, I, R_{t_3}\rangle$, where C is the condition that becomes true when the player has caught 500 fish, and M is the system that monitors how many fish have been caught. I is the presentation of the stamp card where the stamps for the first two tasks, t_1 and t_2, is presented to the player, the current progress indicator to let the player know how many more fish they need to catch to complete the task, and the stamp that is presented to the player when the task is completed. $R_{t_3} = \{r_{31}, r_{32}\}$, the in-game currency and the title associated with the task. $t_4 = \langle C, M, I, R_{t_1}\rangle$, where C is the condition that becomes true when the player catches 2,000 fish, and M is the system that monitors how many fish have been caught. I is the presentation of the stamp card where the stamp for the first three tasks, t_1, t_2 and t_3, is presented to the player, the indicator to the let the player how many more fish they need to catch to complete the task, and the stamp that is presented to the player when the task is completed. $R_{t_4} = \{r_{41}, r_{42}\}$, the in-game currency and the title that is associated with the task. $t_5 = \langle C, M, I, R_{t_5}\rangle$, where C is the condition that becomes true when the player catches 5,000 fish, and M is

the system that monitors how many fish have been caught. I is the presentation of the stamp card where the stamps for the other four tasks, t_1, t_2, t_3 and t_4, are presented to the player, the indicator to let the player know how many more fish they need to catch to complete the task, and the stamp that is presented to the player when the task is completed. $R_{t_5} = \{r_{51}, r_{52}\}$, the in-game currency and the title associated with the task. This definition is able to account for the ordering of the tasks, the multiple rewards that are given to the player as the player completes the tasks in the quest, and the presentation of the quest to the player.

Using the definition proposed in this paper, the Nook Miles+ fishing quest can be defined as $Q = \langle\{t_1 \in T\}, \leq, \{r_1 \in R\}$. t_1 is the task to catch five fish, $\leq$ is the ordering of a single task, and r_1 is the 150 in-game currency. $t_1 = \langle C, M, I, R_{t_1}\rangle$, where C is the condition that becomes true when the player catches five fish, and M is the system that monitors how many fish have been caught. I is the presentation showing that the player needs to catch five fish, an indicator of the player's progress of catching the fish, and a change in the graphic to let the player know that the quest has been completed. $R_{t_1} = \{r_1\}$, the in-game currency reward. Though this quest is much simpler, the proposed definition is able to as easily capture the requirements of this quest as the more complicated Nook Miles quest.

7 Conclusion

Since there is no consensus on the definition of a quest in procedural quest generation, this paper offers a survey of quest definitions proposed in that literature. From this survey, a generic definition of a quest was synthesized, and proposed in a form that can accommodate most of the ideas proposed by previous papers. The hope is to further the discussion for a unified quest definition and encourage more communication in this field. Using a more precise definition of a quest can allow for better reasoning about quests and quest systems, as demonstrated in the analysis section. Additionally, if a consensus can be reached, it will be easier to further research in this area.

References

Aarseth, E. 2005. From hunt the wumpus to everquest: Introduction to quest theory. In Kishino, F.; Kitamura, Y.; Kato, H.; and Nagata, N., eds., *Entertainment Computing - ICEC 2005*, 496–506. Berlin, Heidelberg: Springer Berlin Heidelberg.

Alexander, R., and Martens, C. 2017. Deriving quests from open world mechanics. In *Proceedings of the International Conference on the Foundations of Digital Games*, 1–7. Hyannis, Massachusetts: ACM Press.

Ashmore, C., and Nitsche, M. 2007. The Quest in a Generated World. In *Proceedings of the 2007 DiGRA International Conference: Situated Play*. The University of Tokyo.

Bethesda. 2011. The Elder Scrolls V: Skyrim. PC, PS3, Xbox 360.

BioWare, Electronic Arts. 2014. Dragon age: Inquisition. PC, Xbox 360, Xbox One, Playstation 3, Playstation 4.

Breault, V.; Ouellet, S.; and Davies, J. 2018. Let CONAN tell

you a story: Procedural quest generation. *arXiv:1808.06217 [cs]*. arXiv: 1808.06217.

Carmichael, G., and Mould, D. 2014. A Framework for Coherent Emergent Stories. In *In the Proceedings of the 9th International Conference on the Foundations of Digital Games*. Liberty of the Seas, Caribbean: Society for the Advancement of the Science of Digital Games.

Chongmesuk, T., and Kotrajaras, V. 2019. Multi-Paths Generation for Structural Rule Quests. In *16th International Joint Conference on Computer Science and Software Engineering (JCSSE)*, 97–102. Chonburi, Thailand: IEEE.

Doran, J., and Parberry, I. 2010. Towards Procedural Quest Generation: A Structural Analysis of RPG Quests. Technical Report LARC-2010-02, University of North Texas.

Doran, J., and Parberry, I. 2011. A prototype quest generator based on a structural analysis of quests from four MMORPGs. In *Proceedings of the 2nd International Workshop on Procedural Content Generation in Games*, 1–8. Bordeaux, France: ACM Press.

Game Freak, The Pokémon Company, Nintendo. 2019. Pokémon Sword, Pokémon Shield. Nintendo Switch.

Howard, J. 2006. Designing interpretative quests in the literature classroom. In *Proceedings of the 2006 ACM SIGGRAPH symposium on Videogames - Sandbox '06*, 133–138. Boston, Massachusetts: ACM Press.

Hromada, T.; Černý, M.; Bída, M.; and Brom, C. 2015. Generating Side Quests from Building Blocks. *Interactive Storytelling* 9445:235–242. Series Title: Lecture Notes in Computer Science.

Hunicke, R.; LeBlanc, M.; and Zubek, R. 2004. MDA: A Formal Approach to Game Design and Game Research. In *Proceedings of the AAAI Workshop on Challenges in Game AI*. San Jose, California: AAAI Press.

Ignacio, D. 2013. Crafting destruction: The evolution of the dead space user interface.

Khaliq, I., and Watson, Z. 2018. The Omni Framework: A Destiny-Driven Solution to Dynamic Quest Generation in Games. In *IEEE Games, Entertainment, Media Conference*, 306–311. Galway, Ireland: IEEE.

Kitchenham, B. 2004. Procedures for performing systematic reviews. *Keele, UK, Keele Univ.* 33.

Kreminski, M.; Dickinson, M.; and Wardrip-Fruin, N. 2019. *Felt: A Simple Story Sifter*. 267–281.

Kybartas, B., and Verbrugge, C. 2014. Analysis of ReGEN as a Graph-Rewriting System for Quest Generation. *IEEE Transactions on Computational Intelligence and AI in Games* 6(2):228–242.

Lee, Y.-S., and Cho, S.-B. 2012. Dynamic quest plot generation using Petri net planning. In *Proceedings of the Workshop at SIGGRAPH Asia*, WASA '12, 47–52. Singapore: ACM Press.

Li, B., and Riedl, M. O. 2010. Planning for Individualized Experiences with Quest-Centric Game Adaptation. In *In the Proceedings of the 20th International Conference on Automated Planning and Scheduling*.

Nintendo. 2017. The Legend of Zelda: Breath of the Wild. Nintendo Switch.

Nintendo. 2020. Animal Crossing: New Horizons. Nintendo Switch.

Onuczko, C. 2007. A Demonstration of SQUEGE: A CRPG Sub-Quest Generator. In *In the Proceedings for the Third Artificial Intelligence for Interactive Digital Entertainment Conference*, 110–111.

Pita, J.; Magerko, B.; and Brodie, S. 2007. True story: dynamically generated, contextually linked quests in persistent systems. In *Proceedings of the 2007 conference on Future Play*, 145–151. Toronto, Canada: ACM Press.

Propp, 1895-1970, V. I. V. I. 1968. *Morphology of the folktale*. Second edition, [revised and edited with a preface by Louis A. Wagner [and a] new introduction by Alan Dundes. Austin : University of Texas Press, [1968].

Santos, F. K. C., and Ramalho, G. L. 2012. A Parametric Analysis and Classification of Quests in MMORPGs. In *In the Proceedings of SBGames 2012*, 117–126.

Soares de Lima, E.; Feijo, B.; and Furtado, A. L. 2019. Procedural Generation of Quests for Games Using Genetic Algorithms and Automated Planning. In *Proceedings of the 18th Brazilian Symposium on Computer Games and Digital Entertainment*, 144–153. Rio de Janeiro, Brazil: IEEE.

Soares de Lima, E.; Feijó, B.; and Furtado, A. L. 2014. Hierarchical generation of dynamic and nondeterministic quests in games. In *Proceedings of the 11th Conference on Advances in Computer Entertainment Technology*. Funchal, Portugal: ACM Press.

Stocker, A., and Alvin, C. 2018. Non-Linear Quest Generation. In *The Thirty-First International Florida Artificial Intelligence Research Society Conference*, 213–216.

Sullivan, A.; Grow, A.; Mateas, M.; and Wardrip-Fruin, N. 2012. The design of Mismanor: creating a playable quest-based story game. In *Proceedings of the International Conference on the Foundations of Digital Games*, 180–187. Raleigh, North Carolina: ACM Press.

Thue, D. 2007. Interactive Storytelling: A Player Modelling Approach. In *AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment*, 6. AAAI.

Tomai, E., and Salazar, R. 2012. Simulating Adaptive Quests for Increased Player Impact in MMORPGs. In *The Eight AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment*, AIIDE '12, 185–190. Stanford, California: AAAI Press.

Tomai, E.; Salazar, R.; and Salinas, D. 2012. Adaptive quests for dynamic world change in MMORPGs. In *Proceedings of the International Conference on the Foundations of Digital Games*, 286–287. Raleigh, North Carolina: ACM Press.

Trenton, M.; Szafron, D.; Friesen, J.; and Onuczko, C. 2010. Quest Patterns for Story-Based Computer Games. In *The Sixth AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment*, 204–209. Stanford, California: AAAI Press.

Tychsen, A.; Tosca, S.; and Drachen, T. 2006. Personalizing the Player Experience in MMORPGs. In *Technologies for Interactive Digital Storytelling and Entertainment: Third International Conference*, volume 4326, 253–264.

Vanhatupa, J.-M. 2011. Guidelines for personalizing the player experience in computer role-playing games. In *Proceedings of the 6th International Conference on Foundations of Digital Games - FDG '11*, 46–52. Bordeaux, France: ACM Press.