Guiding Player Perception in Level Design to Influence Game Flow

Master-Thesis

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Abstract

Non-linear levels allow for new design opportunities. However with the increase of interconnectivity within a level the difficulty to design these spaces rise dramatically as it becomes difficult to predict where the player will go and what the player will understand about the game at that point. This thesis investigates how this challenge can be met as well as what advantages non-linear games offer in general. For this purpose, the Level Guidance Method is introduced.

Zusammenfassung

Nichtlineare Level eröffnen neue Designmöglichkeiten, jedoch erhöht sich mit steigender Verzweigung der Welt auch drastisch die Schwierigkeit diese Welt zu designen. Es ist schwer vorherzusagen, welche Wege der Spieler gehen wird und daher auch schwer vorherzusehen, welches Wissen über das Spiel und die Spielwelt der Spieler bis zu diesem Zeitpunkt erlangt hat. Diese Abschlussarbeit untersucht wie dieser Herausforderung entgegnet werden kann und welche Vorteile nichtlineare Spiele bieten. Zu diesem Zweck wurde die Level Guidance Method entwickelt.

1 Introduction

1.1 Motivation

Before 2003 the Game Developer Choice Awards would recognize outstanding contributions to the field of Level Design with the Level Design award. It would then be changed into the award Excellence in Game Design because Level Design and Game Design seemed too interwoven (*Gamechoiceawards*, n.d.). This speaks to the fact that Level Design is not only for visual appeal but an essential tool to structure the game experience. The length of corridors, branching paths, or open fields ultimately influence the pacing of any game.
This is especially true for games that follow a non-linear progression. In 2011 Dark Souls rose to critical acclaim (Wikimedia Foundation, n.d.-b). Touted for its outstanding Level Design it leveraged a strongly interconnected world without losing the player in its complexity.
This begs the question of how and to what benefit? The moment a non-linear progression is introduced the designer gives up some control of how the player experience unfolds. After all the player might choose to go down a path later in the game than anticipated and therefore the difficulty would be under-tuned. So how can a game featuring a non-linear world be designed without leaving the quality of the experience up to chance? And why would game developers favor a non-linear design over a linear design given these challenges?

In this thesis, I investigate these questions. And propose a framework that allows us to better understand and design games with non-linear game worlds.

1.2 Goals and Boundaries

The goal of this thesis is to investigate the following questions:

1. How can a game featuring a non-linear world be designed without leaving the quality of the experience up to chance?
2. Why would a non-linear design be favored over a linear design?

To investigate these questions I propose a theoretical framework and examine its efficacy by analyzing outstanding non-linear video games.

In this thesis, I will reduce the scope to 3D single-player games. The proposed framework will not concern itself with the aesthetics of the world and solely focus on how the player is guided throughout the world.

1.3 Thesis structure

This thesis is divided into five chapters. In the first chapter, I will highlight the motivation and goals for the thesis. In chapter two I will present the theoretical foundation for the proposed Level Guidance Method. Chapter three will explain the method in detail. In chapter four the game “Dark Souls” will be analyzed using the Level Guidance Method as a model. In chapter five I will present the findings of this thesis.

2 Theoretical Foundation

2.1 Level Design

2.1.1 Overview

To gain a better grasp of how non-linear game worlds might work, a clear understanding of what a game world is and what it entails is necessary.
This chapter will first introduce a Level definition and then examine the qualities of levels that are relevant to this thesis. I will use the terms “level, world, space, and map” interchangeably.

2.1.2 Level definition

There are many definitions for levels and their derivative names in the context of video games. Consider the following examples:

- “In video games, a **level** (also referred to as a **map**, **stage**, or **round** in some older games) is any space available to the player during the course of completion of an objective.” (Wikimedia Foundation, n.d.-e)
- “A **level** is a space where a game happens.” (*What Is Level Design*, n.d.)

Jesse Shell’s “The Art of Game Design” does not directly describe what a level is but somewhat indirectly through its chapter on level Design:
“We’re nearly at the end of this chapter, and we haven’t yet talked about level design. Or have we? In truth, we have been covering it all along! Not just in this chapter, but through the entire book. All a level designer does is arrange the architecture, props, and challenges in a game in ways that are fun and interesting—that is, making sure there is the right level of challenge, the right amount of reward, the right amount of meaningful choice, and all the other things that make a good game.” *(Schell & Schell, 2008).*

Understanding designing a level as “arranging the architecture, props, and challenges …” implies that the level is the things that are arranged. This definition differs from the other two in a meaningful way. The previous definition revolves around **space** while this definition includes **challenge**, **reward**, and **meaningful choice**.
A framework to analyze Level Design should take this into consideration and not focus solely on space and topology.

This definition however can also be challenged. Looking at interface elements that provide meaningful choice and challenge it becomes clear that the definition must be contrasted against what it is not (see figure 2.1).

Figure 2.1

The limited inventory space in Diablo 2 Resurrected forces the player to rearrange the space to allow for larger items as well as forcing the player to make choice of what items to collect and carry

Diegesis theory helps to make a distinction between interface and game world (Russell, n.d.).
Consider the following examples: When intense background music plays during a combat scene it is only heard by the player, not by the characters within the game. In contrast, the footsteps in a stealth game might be picked up by characters within the game, not just the player. We would consider the former as non-diegetic and the latter as diegetic. Other elements of games such as the interface can also be analyzed in such a manner. Diegesis theory, therefore, splits all narrative representations from elements that are in support of the narrative but are not embedded in it.

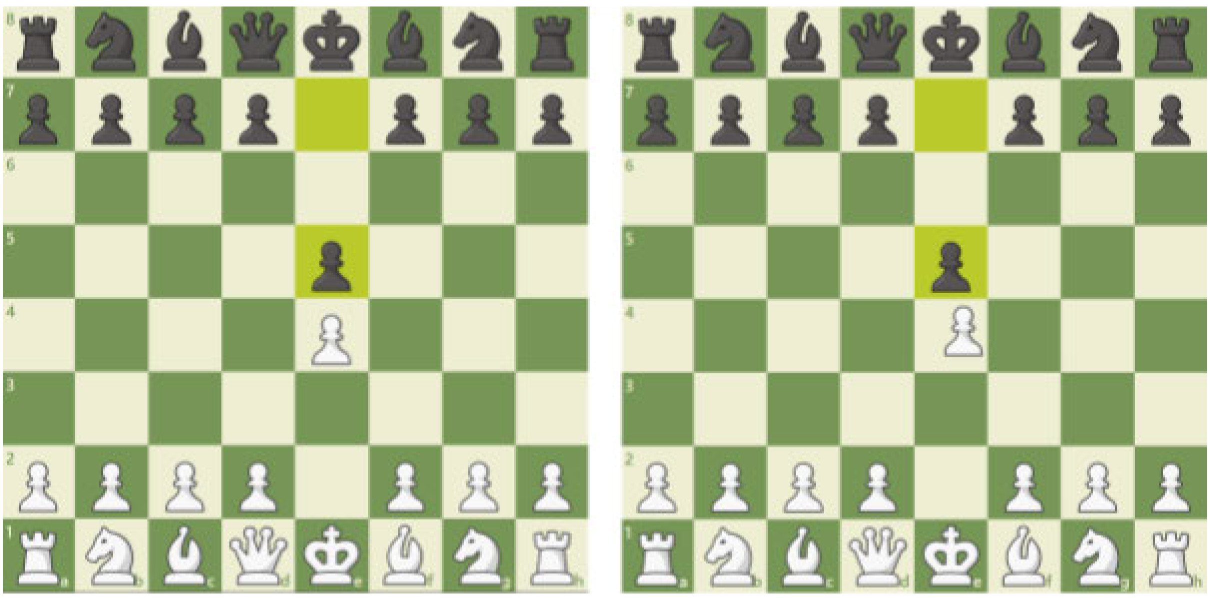
By examining non-linear worlds this thesis concerns itself with the diegetic world. It includes all elements that affect the challenge, reward, and meaningful choice of the given world space.
Beyond the world itself, non-diegetic elements such as map interfaces will be taken into consideration.

2.1.3 Qualities of Levels

2.1.2.1 Continuity

Levels have rules on how they are traversed and can broadly separate these into two categories: **discrete** and **continuous**.
Discrete levels only allow the movement of actors from a predefined area to another predefined area. Movement within these areas is either not possible or ignored by the rules of the game. Looking at the example of chess a pawn may move one square forward however its position within that square is irrelevant to the game. See figure 2.2.

Figure 2.2



Left and right chess boards are mechanically equal
despite the offset of the pawn on e4

Figure 2.3

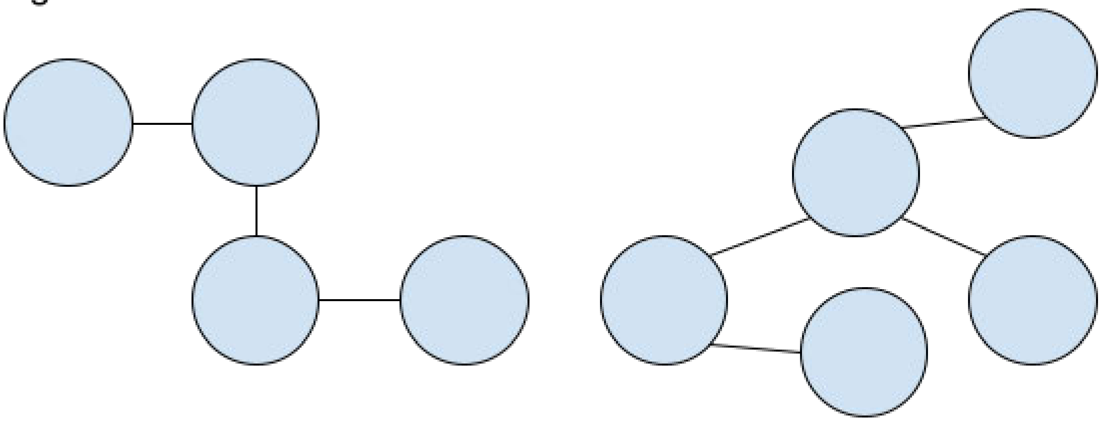
Legend of Grimrock 2 puzzle

Continuous levels are instead concerned with the absolute position of the actor.
Many games that feature non-linear level design are continuous however, this is no prerequisite. Games like Legend of Grimrock 2 (see figure 2.3) feature a discrete non-linear world.

2.1.2.2 Topology vs Geometry

The geometry of the game world plays a defining role in level design. It lays the foundation of how the world can be traversed and through the size of spaces and length of paths it also affects the time and therefore the pacing of navigating the world.
There is however a different way to look at the geometry that is meaningful. I will use the term topology here as it most accurately describes this view.
The actual size of level geometry, the length of paths, and verticality are irrelevant when analyzing the interconnectivity of a game world. By reducing areas to vertices and paths to lines an abstract graph of the interconnectivity of the level can be established. This allows comparison from one game to another or even from one segment of a game to another (see figure 2.4).

Figure 2.4



Linear level A

Non-linear level B

2.1.2.3 Dimension

Figure 2.5

The game doom using projection techniques to achieve 2.5D

Games can be classified by their spatial dimension (e.g. 2D games, 3D games) however, this can relate to many things from the way objects are rendered to the type of camera perspective or the traversable game space.
This leads to terms like 2.5D which can refer to a game that is rendered in 3D but features a 2-dimensional game world but may also refer to a game that uses projection techniques to create a 3D world out of 2D images (see figure 2.5) (Wikimedia Foundation, n.d.-a).
This thesis is limited to non-linear 3D games, therefore it is helpful to evaluate the distinctions between 3D and non-3D games.

If we model the game world as a topological graph, that is to interpret places within the game world and their connecting paths, the different qualities of dimensions become apparent. In 2D non-linear worlds paths either connect to adjacent places or eventually cross another path, while in 3D worlds verticality can be used to avoid crossings.
3D games also offer the opportunity to employ a first-person or third-person perspective. in contrast to a top-down or a side view, this allows the designer to lure the player's gaze and therefore emphasize or deemphasize certain perspectives.

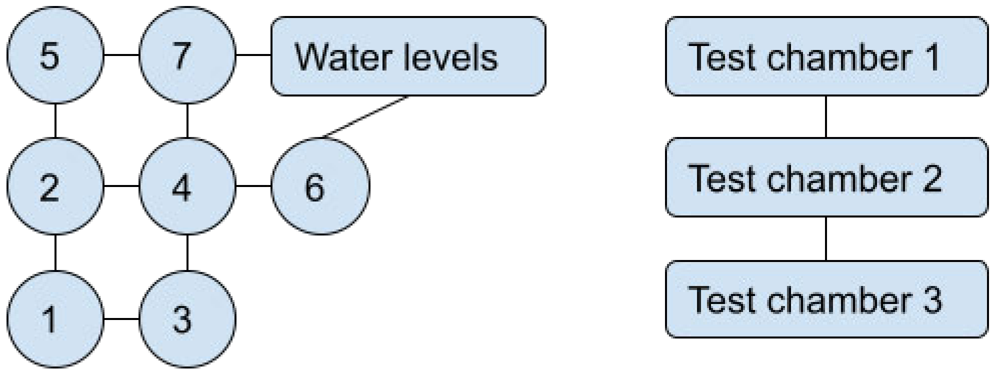
The dimension of time is of interest to level design when it comes to movement. The time it takes for the player to traverse the level affects the overall experience of the level. It is important to recognize that a game may allow for a change in movement modalities. For example, in Grand Theft Auto V the player can enter vehicles such as cars, motorcycles, or airplanes. Here it also becomes apparent that not only does this affect the time it takes for the player to traverse the level but also the available path the player can take. A motorcycle may enter narrow alleys, a boat can traverse water but not land.
I want to specifically highlight the movement modality of “teleportation” as it uniquely affects the interconnectivity of the playspace. In Skyrim for example the player may “fast travel” to any previously visited location in the overworld, as long as the player is not in combat.
This teleportation effectively connects areas of a level without any connecting geometry. When mapping a game world as a topological graph these areas are connected with paths with a length of zero. This also allows 2D games to connect nonadjacent places without crossings.

2.1.2.4 Linearity

“Goals in a game may be primarily linear: defeat a succession of harder and harder opponents, beat the game on an increasing series of difficulty levels, or complete a series of story quests in order. They may also be nonlinear (i.e., independent of one another): win a battle using only marines, complete a task without resorting to combat, or find the hidden flower.” (Elias et al., 2012)
The quality of linearity can be understood as the progression from goal to goal or from an experience to the next. A progression that cannot change is linear and by definition everything else is non-linear.

This quality can also be understood in terms of topology. A linear game in this sense moves from one set place to the next. An example would be the game “Portal” where the completion of a puzzle is followed by the next puzzle and so on. The player is not able to solve the puzzles out of order or skip some of them. In contrast, would be a non-linear puzzle game like “Baba is You” where the player can choose between different puzzles and does not necessarily need to solve all of them to progress.
“Baba is You” is also an example of a more granular distinction of linearity. The player must solve a certain number of puzzles to unlock the next set of puzzles. Only looking at the sets it would classify as a linear game, as there is only one way to progress. This shows that the degree of linearity can change throughout a game and the diversity of progression can thus expand and contract depending on its topology (see figure 2.6).

Figure 2.6



Progression in Baba is You

Progression in Portal

2.3 Quality of Experience

2.3.1 Overview

To understand the structure of a game's experience and what may be considered a “good” experience this chapter will examine different frameworks and considerations.

2.3.2 Core Loop

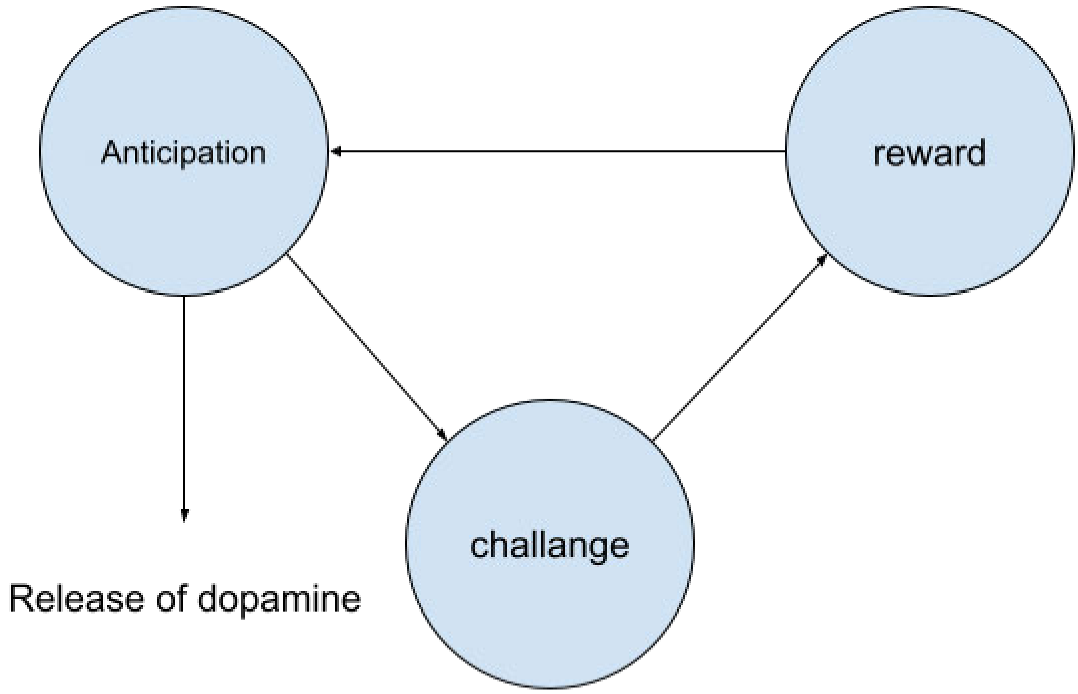
(Kim, n.d.) distinguishes between the core loop and the compulsion loop (see figure 2.7) as follows:

- “Compulsion Loop: A habitual, designed chain of activities that will be repeated to gain a neurochemical reward: a feeling of pleasure and/or a relief from pain.”
- “The core loop is the chain of activities associated with the primary user flow. What is the user primarily doing over and over again?”

When modeling a game's experience we can look at the common actions of the game and see how their repetition relates to one another. The compulsion loop also explains why we have these repetitive structures in games in the first place. Based on the research of B. F. Skinner a compulsion loop is designed to create a predictable or desired player behavior.

It is difficult to argue whether such a loop creates a “good” experience as the player is engaged with the game not necessarily out of joy but rather through habituation. In any case, it affects the player experience as well as the player behavior so modeling it helps us to understand the structure of that experience.

Figure 2.7



2.3.3 Player Types

If we study our own behavior, we can observe that we are not only interested in different games by a differing amount but also that other players don't necessarily share the same level of interest as we do. This begs the question, if the gameplay experience is the same for everyone why is not everyone showing the same amount of enjoyment/interest in a game?

The simple taxonomy of player types by Bartle was introduced as an answer to what players want out of a MUD (multi-user dungeon). Bartle came to the conclusion that different players had different preferences so their areas of enjoyment would be different too. The player types are as follows (Bartle, 1996):

- Killers interested in acting on other players
- Achievers interested in acting on the world
- Socializers interested in interaction with players
- Explorers interested in interaction with the world

As the game industry evolved more in-depth taxonomies were developed. Part of the Engine of Play model by Jason VandenBerghe includes the "4 domains of play" that maps player tastes to their personal traits (see figure 2.8). These traits are measured by the 5-factor model and thus provide, in contrast to Bartle's taxonomy, a solid scientific foundation. The trait of neuroticism was dropped from the model as it had no strong correlation with player preference.

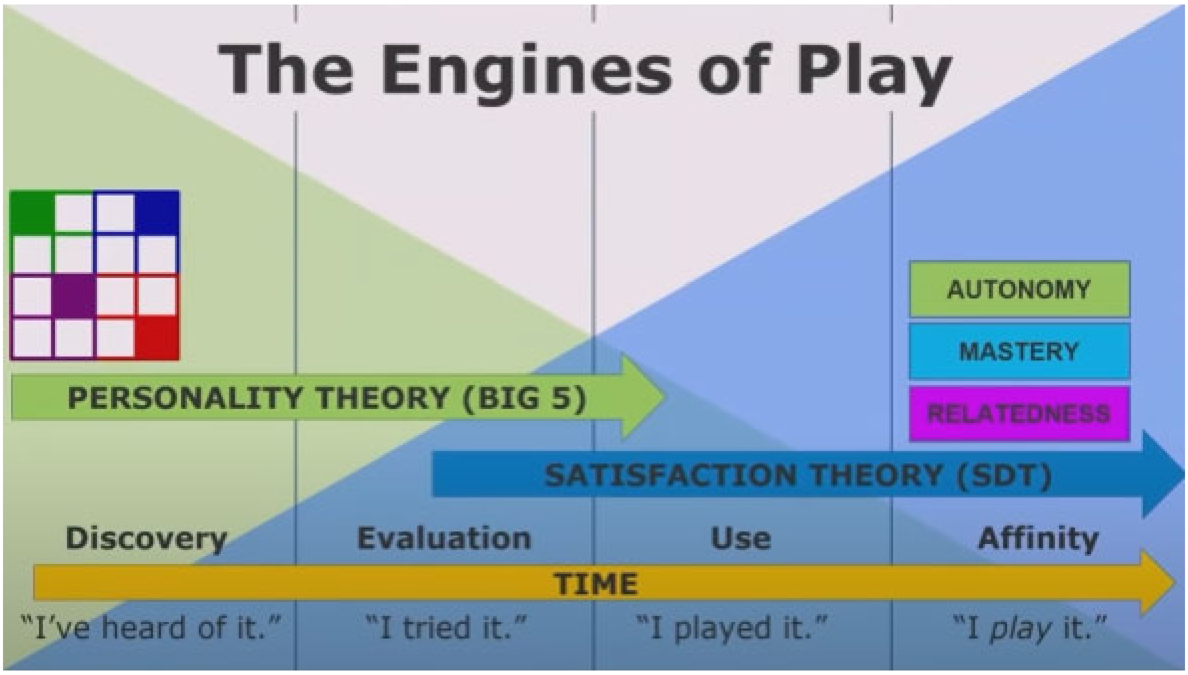
Figure 2.8

From this model, 256 player types can be derived. VandenBerghe also makes the argument that the more extreme personality traits of a player dominate the interest in particular video games. The interest of someone who is somewhat ambivalent about the realism of a game will neither be excited nor diminished by hyper-realism.
The Engine of Play model however also highlights a change in player motivation. While our initial interest in a game may be fuelled by our individual taste this wanes over time and is gradually replaced by other motivations explained by Self-Determination Theory. (VandenBerghe, n.d.)

2.3.4 Self-Determination Theory

According to VandenBerghe SDT (Self-Determination Theory) becomes a better predictor of player engagement the longer the player is engaging with the game. This also means that player taste or player type, while being the deciding factor in the beginning, is of little relevance in the long run (see figure 2.9).

Figure 2.9



SDT is concerned with people's motivations in the absence of external factors. Here the distinction is made between external motivation, for example getting money for the completion of a task, and internal motivation (completing the task for the sake of completing it).
VandenBerghe highlights three needs that should be met for an optimal experience:

- **Autonomy**: Universal want to act in harmony with one's integrated self, making choices and seeing the results of those choices reflected in the world.
- **Mastery**: Universal want to seek to control outcomes.
- **Relatedness**: Universal need to interact and be connected to people.

If a game touches all these areas players are more likely to enjoy the game over longer time spans. This general interest can also then apply to sequels of the video game. (VandenBerghe, n.d.)

2.3.5 PENS Model

Based on SDT the researchers of Immersyve developed the PENS (Player Experience of Need Satisfaction) model. This model applies SDT specifically to games and makes tangible claims about how a game should be designed to satisfy autonomy, mastery, and relatedness.
On **mastery**, the PENS model highlights the importance of not only sustained optimal difficulty but also the need for the player to express their mastery of the game. This expression is not found in barely overcoming hard challenges but rather overcoming challenges consistently and with ease. The player, therefore, feels validated in their mastery over the game.

For **autonomy**, the PENS model argues for maximizing the player's opportunities for actions. These actions should be real alternatives that provide a solution for a problem in the game or lead to new opportunities for actions. Furthermore, the player's expression of who they will be in the game world also factors positively into the autonomy aspect.
For **Relatedness**, the PENS model comes to the conclusion that even single-player games can satisfy this dimension. A game should allow for means of expression for multiplayer games. For single-player games, it is best if the characters of that game acknowledge the player's autonomy and mastery to allow for better relatedness.
(Rigby et al., n.d.)

2.3.6 Flow State

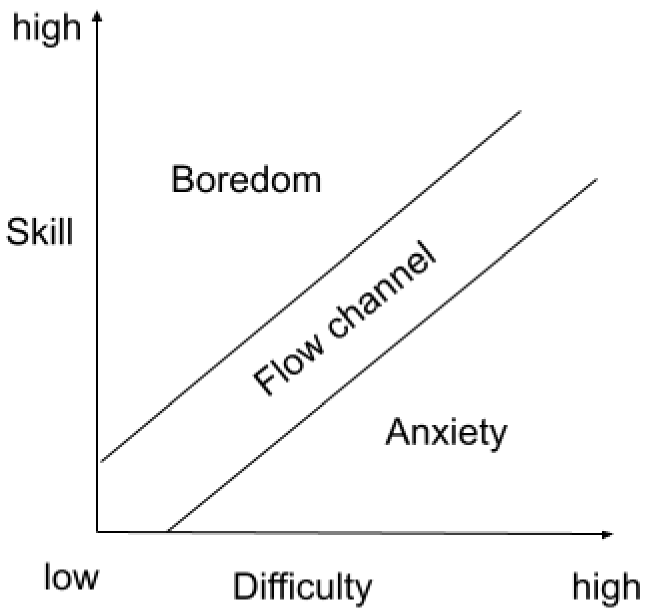
Mihály Csíkszentmihályi's Flow differentiates between pleasure and joy. We can experience pleasure without any investment of effort, whereas enjoyment roots in an unusual investment of attention.
If this joy reaches the level of the optimal experience it is referred to as a flow state. Being in the flow state usually includes some if not all of the following conditions:

- Being confronted with a task one has the chance to complete.
- One has the ability to concentrate and not be distracted.
- The task undertaken has clear goals.
- The task provides immediate and accurate feedback.
- Having autonomy over one's actions.
- The loss of the sense of time.
- The disappearance of self-concern

To allow the player to meet some of these conditions the following steps can be taken: To allow the player to lose self-concern the game should challenge the player to the degree that all their skills are needed to overcome the challenge. Increasing the challenge beyond this point has adverse effects. This leads to the complete absorption of the player's attention allowing for no room for self-concern and the player gets lost in the action.
Games should state clear goals for the player. This does not need to be done explicitly as long as the goal is clear. Feedback on the progress of the goal should be immediate and clear.
(Csikszentmihalyi, 1990)

Designing video games for the flow state comes with the difficulty of player progression and player diversity. A game designer has to consider the player's improvement over time to ensure an optimal experience. A great challenge is a difference in the skill level of players. While some might struggle at a given challenge, others might find it easy and underwhelming.

Figure 2.10



There must be a balance of challenges (see figure 2.10). As the player adapts to the challenges so must the game adapt to the player. Different players enjoy different levels of difficulty.

2.4 Player navigation

2.4.1 Overview

To understand how players may or may not get lost in a non-linear game world this chapter will first examine the nature of perception and navigation.

2.4.2 Goals

For the player to navigate any space they first must perceive their environment, set a goal or have a goal, and make a plan to get from where they are to where they want to go.
Goals can be quite mundane like seeing an npc and wondering if there is a new interaction, or seeing an interesting building in the distance. Goals can also be vaguer and grander in scope like: “I want to explore the swamp area”, or “I want to defeat the boss in the mountains”. Goals can be implicit and set by the player but also explicit. A quest marker might highlight a specific point in the game world (see figure 2.11), or the quest log states “kill the archbishop”.

Figure 2.11

A quest marker on the compass of the HUD as well as on the door guide the player

2.4.3 Player perception

While perception at first glance seems quite straightforward this topic holds more nuance that is relevant to the thesis.
We encounter numerous novel objects in our lives and despite their novelty, we have some kind of approach on how to handle them. These approaches may not always have the desired effect as anyone pushing on a door that needs to be pulled understands. This begs the question of how to get our initial idea of how to operate anything we don't know about in the first place.
The best description of how this process works can be found in **affordance**.“An affordance is a relationship between the properties of an object and the capabilities of the agent that determine just how the object could possibly be used.“ (Norman, 2013)
A hammer, for example, affords to be held. Likewise, a hammer does **not** afford to be sat on. It is of course possible to sit on a hammer however it is neither a smooth, soft, or large enough surface to sit on.
An important observation here is that affordance is a relationship between object and agent. For humans, the hammer might afford to be held and not to be sat on, for a fly however we can consider this reversed.
How does this concept apply to the subject of this thesis then? When a player perceives a road that road obviously affords to be followed and to be traveled. When looking at games that unlock new movement modalities over time, like in hollow knight where the player acquires the ability to wall jump later in the game, it becomes clear that the affordance of

objects in a level can change over time. Furthermore, this allows the designer to introduce a new perspective to the player at planned points in the game.
Another effect is that players' affinity to challenges shapes their perspective. For example, a dragon might be inviting for some players, while others consider it a barrier.
This opens the opportunity to design challenging encounters in a way to divide players into groups with a similar taste for challenge and skill. This would then in turn allow for the subsequent level design to be catered to that specific group.

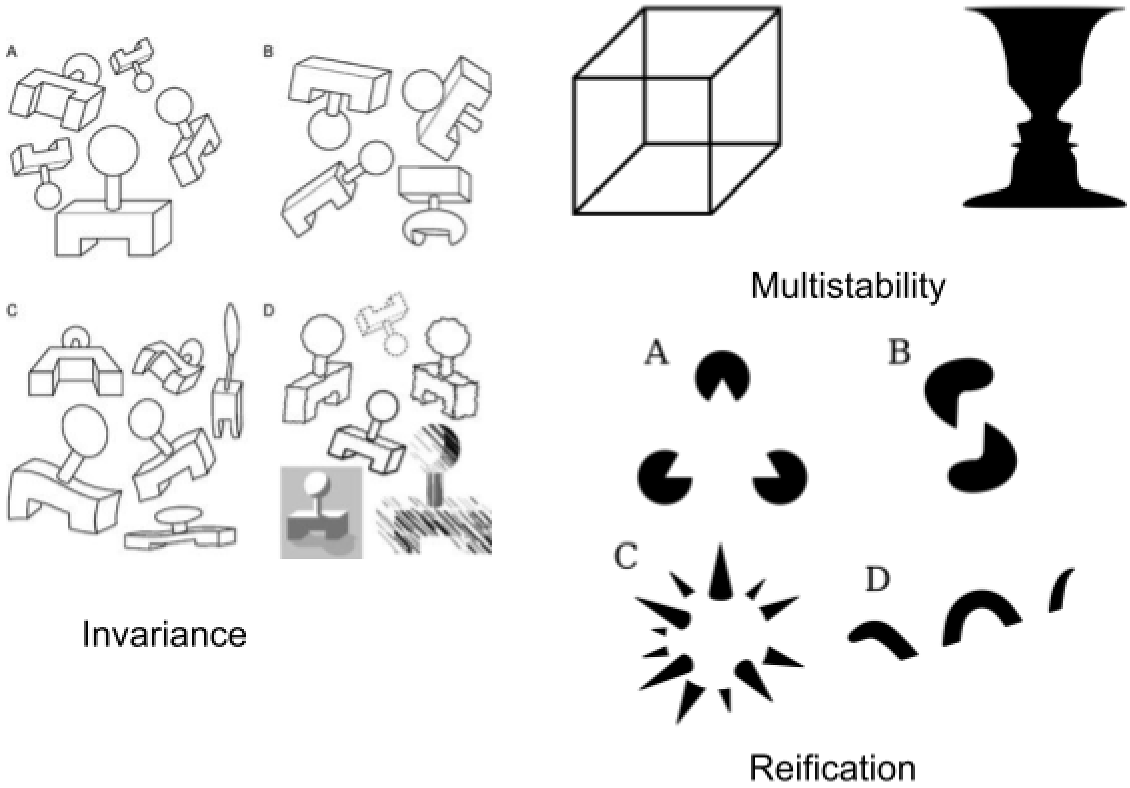
2.4.4 Gestalt Psychology

Another theory that is important to the concept of player perception is gestalt psychology. While affordance is a concept that deals with the interaction with objects the question remains how we perceive objects in the first place. One could say that a dog is not a dog but a set of legs, a head, a torso, and a tail, however, we do not do such a thing. A dog is perceived as a whole and gestalt psychology seeks to explain the nature of this wholeness.

The key principles of gestalt psychology are as follows (also see figure 2.12 for examples):

- **Reification**: Construction of experience perception that exceeds the visual stimulus.
- **Multistability**: The tendency to jump back and forth between multiple visual interpretations when confronted with an ambiguous visual stimulus.
- **Invariance**: The ability to identify an object even when it is rotated distorted or otherwise manipulated.
- **Emergence**: When multiple visual stimuli create a new distinct visual stimulus as the sum of its parts.

Figure 2.12



Also to note is the concept of Prägnanz. It deals with the “hanging together” of things. It produces the following laws:

- **law of proximity**: Things grouped closer together.
- **law of similarity**: Things of similar property, for example, color.
- **law of closure:** If a pattern or shape is incomplete it will still be perceived as such a pattern or shape.
- **law of symmetry**: Symmetrical shapes originating from a center point are perceived as connected.
- **law of common fate**: Moving objects are grouped together by their similarity in direction and speed
- **law of continuity**: Objects obstructed and therefore split in half by other objects are still perceived as one object.
- **law of past experience**: Under some circumstances, the trained perception of objects overrules the perception that other laws would predict. For example, in the case of letters, an “LI” read as a series of two “l”. While the law of closure would suggest perceiving it as a “U”.

(Wikimedia Foundation, n.d.-d)

2.4.5 Cognitive map

To find our way in any space requires some form of knowledge or information about that space. This chapter investigates how this process of knowledge or information acquisition works for the player.

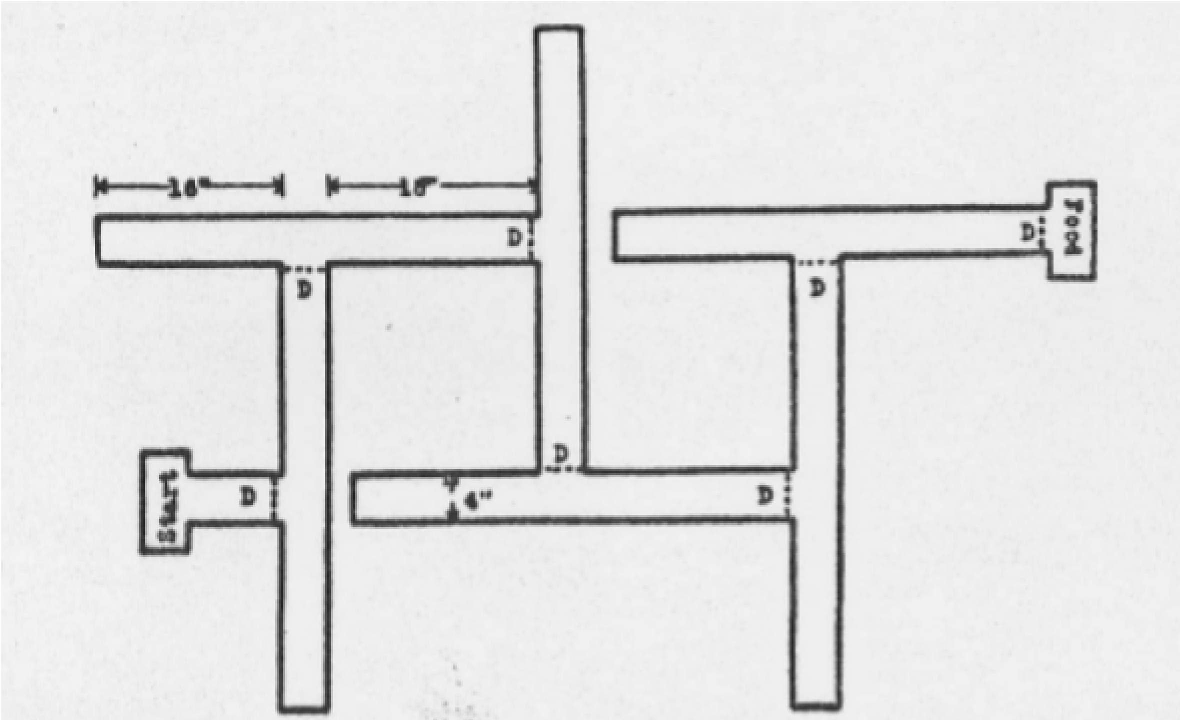
(Tolman, 1948) lays out how rats learn to navigate and deal with mazes. In the highlighted experience rats are put into a maze often with some kind of reward at the end. The goal of these experiences is to investigate whether a rat's behavior is explained by a simple response to external stimuli or whether the rat's behavior also includes some form of cognition. In the former interpretation, the rat put into the maze responds to the new environment stimuli with a learning behavior so to speak.

Tolman divides these tests into 5 categories:

- Latent learning
- VTE (vicarious trial and error)
- searching for the stimulus
- hypotheses
- spatial orientation

Latent learning is the process in which we process information without being aware of it or actively pursuing to process that information.
In the test from latent learning three groups of rats are put into a maze once a day. The control group gets food as a reward at the end of the maze. Group two gets no food at the end of the maze for the first six days. Group three gets no food for three days. The error rate (the times the rat chooses the wrong path) is recorded for every rat (see figure 2.13 for an example).
For the control group, there is an incentive to finish the maze and the error rate declined over the course of days. The other groups have no initial incentive and don't seem to improve their error rate. On day six or three respectively when the food is given as a reward the error rates also drop for the other two groups. On subsequent days the error rate of these groups drops dramatically faster than the control group. This implies that the rats, even though they had no motivating factor, were processing their environment and developed a cognitive map of the maze.

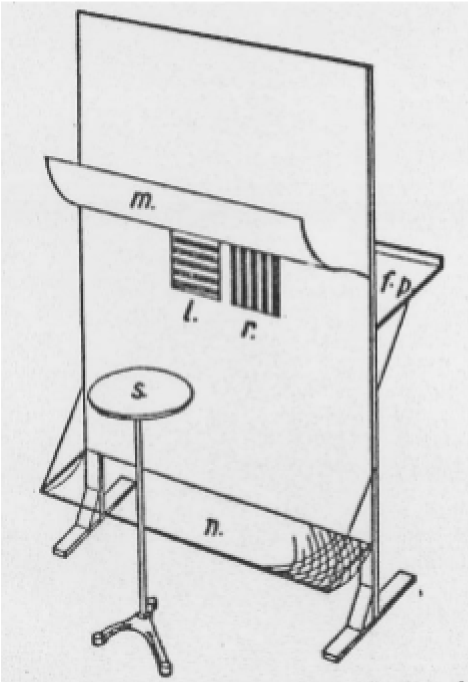
Figure 2.13



Experiment setup to test for latent learning

VTE is the hesitation or consideration before making a decision. In the experiments for VTE, the rats are given to option of a different colored or striped door. By changing the difficulty of discerning the stimuli, for example instead of a white and black door use a white and grey door, the change of the VTE response can be measured.
Interestingly the rats initially seem to have a longer VTE response to stimuli that are easier to distinguish. Tolman predicts that this is because the rat actually first needs to learn that the stimuli of the colors are somehow relevant and related. By introducing harder-to-discern stimuli to rats that have already understood the “instructions” of the test the VTE response increased again (see figure 2.14 for an example).

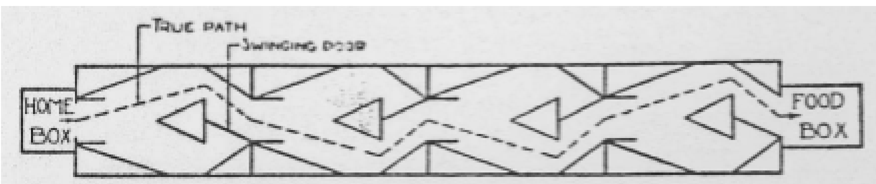
Figure 2.14



Rats jump from the chair (s.) to either the right or left door. Only one door opens. If the rat chooses the wrong door it is caught in the net (n.) and the experiment is repeated.

In **searching for the stimulus** test the rat is put into a cage with a food cup mounted on a striped pattern in it. The rat gets an electric shock when stepping on the pattern. Once that happens the rat would assess where the shock came from and avoid it. When the experiment was rigged in a way that the lights turn off during the shock the rat would not show that avoidant behavior or avoid completely unrelated things in the cage.
In the **hypotheses** experiment, the rats are put into a series of discrimination compartments. Each compartment features one correct and one incorrect door (see figure 2.15). The right doors can be a combination of left, right, light, and dark with a total combination of 40 possibilities.

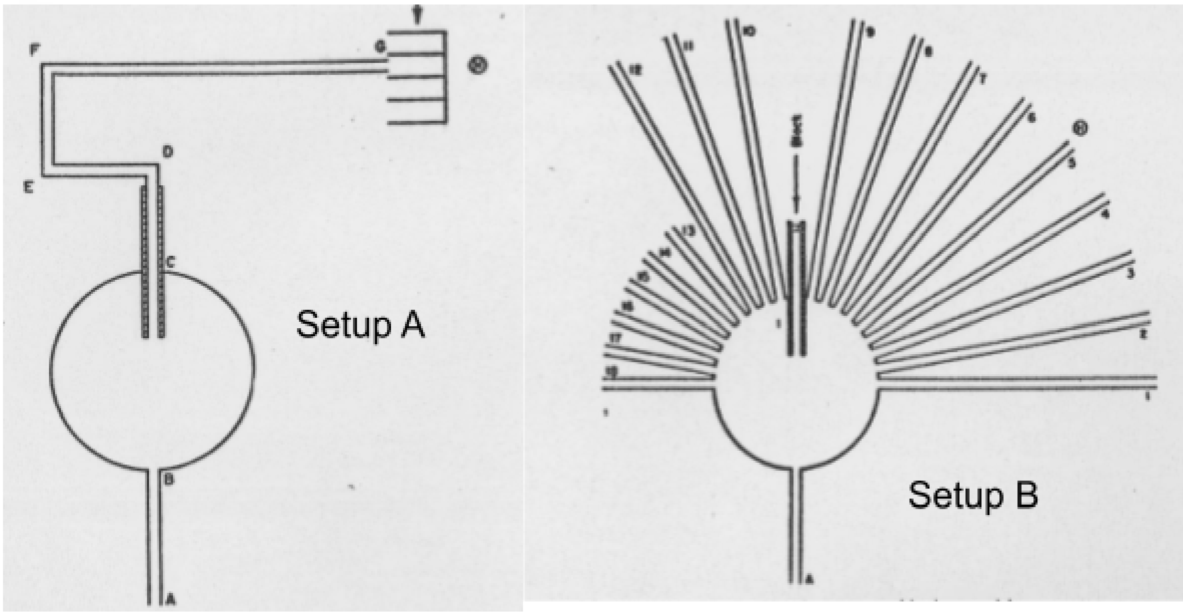
Figure 2.15



The rats in this experiment would choose among one characteristic and for example “left” and continue to try left for the next compartments. When this fails the rat may choose “always dark”.
The **spatial orientation** experiments are designed to test the width of the cognitive map. In these experiments, rats learned a specific path to the food box. Later the maze would be changed offering new pathways in a radial pattern and removing the original path to the food box (see figure 2.16). The rats first go down the path they expect the food. When they realize that there is no food they return to the start and investigate. The first path taken is

then recorded. Most rats choose the path that would end up closest to where to food box originally was.

Figure 2.16



The rat first learns the setup A and is later put into setup B to test for spatial orientation

Considering that these experiments only speak to rat's behavior Tolman also seems to believe that the concept of cognitive maps also applies to humans. Furthermore, he concludes that narrow maps, that is unsophisticated maps, seem to be induced by the following:

- Brain damage
- The inadequate array of environmentally present cues
- Overdose of repetition on the original trained-on path
- The presence of too strongly motivational conditions
- The presence of too frustrating conditions

Translating all of this into the navigation in non-linear games there are several lessons that can be drawn from this body of work.
It can be assumed that as long as the environmental stimuli are concise and diverse the player will naturally build a cognitive map of the game world. Furthermore in situations that are highly engaging or frustrating the player may build a cognitive map that is unsophisticated and thus leads to difficulties navigating that space later.
Also, it is to be assumed if the player has a goal in form of an explicit point in space they will try to take the shortest most intuitive route.

In video games of course, the player may not only rely on his cognitive map but the game may provide a map in form of a HUD display, menu option, or even an actual diegetic map.

2.4.6 Patterns of Guidance

In order to gain a better understanding of how designers lead players through their levels (Milam & El Nasr, 2010) examined the use of patterns through expert interviews and game analysis. First, the experts were interviewed and then the researchers abstracted a set of patterns based on the analysis of those interviews. Then, video recordings of playthroughs were shown to the experts to evaluate: 1) whether the patterns are an accurate depiction and 2) whether these accurately represent the implied result.

The following patterns emerged from this body of work:

Collection pattern: The player is drawn to rewarding items like a new weapon or, coins.

Path target pattern: Orients the player's attention or movement to visible targets in the level. This behavior reinforces horizontal or vertical scanning.

Pursue AI pattern: Incentivise to move around the level in response to hostile or friendly characters. An example might be to chase down a foe or avoid their attacks.

Path movement resistance pattern: The player is drawn by the general narrative goal for the player to progress. This progress can be with or without resistance, meaning in this case a blocked path for example. This can also be used in conjunction with other patterns. The player might have to fight the boss of a certain area but needs a key (**collection pattern)** to unlock the door to the boss fight. This pattern can be understood as the overarching motivation of the player to pursue a direction.

Player is vulnerable pattern: When to player is in danger of suffering consequences. For example when a player can “die” their main goal may be determined by a **path movement resistance pattern** however their sub-goal is to stay alive so this pattern can be used as a form of resistance.

The researchers note that during their analysis there were many instances that include two patterns at the same time.

3 Level Guidance

3.1 Overview

In this chapter, I present my answers to the questions of the thesis. To reiterate these are the research questions:

1. How can a game featuring a non-linear world be designed without leaving the quality of the experience up to chance?
2. Why would a non-linear design be favored over a linear design?

I will use the research from chapter 2 to form my argument for both these questions and develop a model as to how the first question can be satisfied.

3.2 Non-linear Advantage and Disadvantage

To answer why a non-linear design would be favored over a linear one I will first highlight the obvious disadvantages.
A non-linear game world requires more design work to get right as there are more “moving” parts so to speak. Also in the same light non-linear games are more difficult to playtest as the potential path a player could take rises almost exponentially with each new path. Furthermore, players in a linear game have an easier time orienting themselves in the world as their way forward is always clear.
I conclude that non-linear games are not favorable in terms of difficulty of implementation and production time.
Now to the advantages. As in chapter 2.3.6 Flow is described to achieve the optimal moment-to-moment experience the player should be adequately challenged. This proves a challenge as each player's skill level differs to some degree. Some games try to remedy this difference by having different difficulty modes. In Skyrim for example the different difficulty modes change the damage the player and enemies take from a quarter up to three times as much damage. Another way to remedy this is by adjusting difficulty dynamically to the performance of the player. The game Crash Bandicoot slows down obstacles, gives extra hit points, and adds continue points according to the player's number of deaths (Wikimedia Foundation, n.d.-c).
While non-linear games do not automatically solve this problem I will make the case that this can be done elegantly without the artificial inflating or deflating difficulty through the use of Level Guidance which I will describe in detail in the next chapter. Here non-linear games are favorable if the desired effect is to provide a natural adaptive difficulty gradient.
Another advantage derived from chapter 2.3.3 Player Types in both Bartle’s taxonomy as well as in VandenBerghe's 4 Domains of Play is the appeal to the “explorer” type of player. While linear games may also appeal to explorers it is safe to argue that non-linear games can offer more of an initial intrigue.
Furthermore, as the player gets more and more involved in a game the deciding motivation changes as described in chapter 2.3.4 Self-Determination Theory. Non-linear games can lean into the PENS Model described in chapter 2.3.5 with some unique advantages.
First of all the knowledge of the intertwined game world is a type of **mastery**. As the player navigates the world in the later stages of the game (or in subsequent playthroughs) they can enjoy the expression of that mastery. It allows for the overcoming of challenges with consistency and ease that the PENS Model advocates for.
Also, the way the player chooses to navigate an intertwined space can also be understood as a matter of **autonomy** by maximizing the player’s opportunities for actions as they choose the order with which to tackle the game. A key importance here is that the opportunity space may grow close to exponentially while the number of paths and areas only grow linearly due to interconnectivity.
Of cause linear games can also provide mastery and autonomy in the long run, however, in a non-linear game, this becomes an emergent property.

3.3 Level Guidance Method

To answer the question “How can a game featuring a non-linear world be designed without leaving the quality of the experience up to chance?” I propose the Level Guidance Method.

This method also indirectly answers the second question “Why would a non-linear design be favored over a linear design?” because answering the first by proposing a method to control the experience also shows in some cases how this experience cannot be achieved in linear games.
It should be noted that the Level Guidance Method is not the definitive way to structure a non-linear game but rather a method that simply meets the requirement of controlling the experience.
The Level Guidance Method utilizes the different perspectives and inclinations of different player types to implicitly guide the player through the non-linear level producing a semi-predictable path for that player.
Furthermore, it is considerate of change in motivation discussed in chapter 2.3.4 Self-Determination Theory to ease the “grip” on the player and allow greater player freedom as the player gets accustomed to the game.
Lastly, it recognizes the nature in which the player gets to understand their environment (as discussed in chapter 2.4.5 cognitive map) and enables them to navigate a complex world without frustration.

So what would such a method look like? I will break down the method in the following steps:

Step 1 - Dividing the Topology:
The level is understood as divided into multiple areas and noted how these areas are connected. This relates back to chapter 2.1.2.2 Topology vs Geometry. Generally, we can consider any choke point like a door or narrow pathway as a connection and everything else as an area.

Step 2 - Cohesion Path:
A cohesion path is declared. This path is to be designed in a way to appeal to the core audience that plays the game for the first time. This is the path that teaches the player through tutorialization and is to be considered somewhat like a “linear game”. It is also the main point where all other non-linear paths are to be branched from. The player is more likely to encounter all branching paths this way. The entrance to a branching path is to be presented to the player in a relaxed environment. This will reinforce the cognitive map of the player and allow them to more easily navigate the space, while not losing orientation. The cohesion path should not branch or at least merge after a very short duration. However, at later stages of the game, it can be considered to relax this requirement. This allows the designer to have control over the experience. It also begs the question if a path branches from the cohesion path how will the designer know that they follow specifically this path? This will be explained in the step **Introducing Locks and Lures**.

Step 3 - Presented Difficulty:
The cohesion path occasionally and purposefully confronts the player with a strong difficulty while presenting an alternative path. The alternative path is to be considered the cohesion path while the difficult path is to be considered optional but strongly encouraged. This allows players that have a high skill level or generally seek challenges that exceed that of the general target audience to be satisfied. Overcoming these challenges should provide adequate rewards.

Step 4 - Optional Paths:

Optional paths are added wherever there is a natural increase in difficulty. As the player progresses through the game and therefore an increase in skill is to be expected, the game adapts to these changes. However, some players may have difficulties facing tougher challenges or have a different tolerance to difficulty. These optional paths are to be designed to allow the player to get accustomed to new challenges and provide new opportunities and powers to tackle new challenges. They start from the cohesion path and loop back to it. It should be noted that optional paths should not allow to skip parts of the cohesion path and always loop back to an area that has already been traversed. This solves two problems. It allows for another player profile to enjoy an optimal experience (in accordance with flow), while at later stages (when the driving motivators are better predicted by the SDT-Model) allows all players greater autonomy in how to tackle and navigate the game. Just like in the step of the cohesion path this begs the question of how to control what type of player goes down this path. This will also be explained in the following step.

Step 5 - Introducing Locks and Lures:
The key to the Level Guidance Method are the locks and lures. To allow branching paths from the cohesion path without jeopardizing its function a mechanism is needed that invites some players in while repelling others. I have discussed many of these mechanisms in chapter two for example how different perspectives affect affordance or how different player profiles are drawn to different experiences at different times. Deriving from these I introduce four different types of “locks” that are different in function and purpose. These locks come in different “hardness”. A hard lock is a lock that bars entry unless a specific key is obtained. The classical example is a locked door. A soft lock does not necessarily block the player even if they do not possess the key. For example, a difficult enemy might bar the way, but the player also has the option to just run past the enemy which is a much less difficult challenge. These are the following locks:

Mechanical Lock:
The mechanical lock is a path that is closed by a game mechanic. The obvious example is a door, however, this also applies to powerups that allow the player to reach new places. This lock can be used to control the sequence of areas the player progresses in (see figure 3.1 for examples).

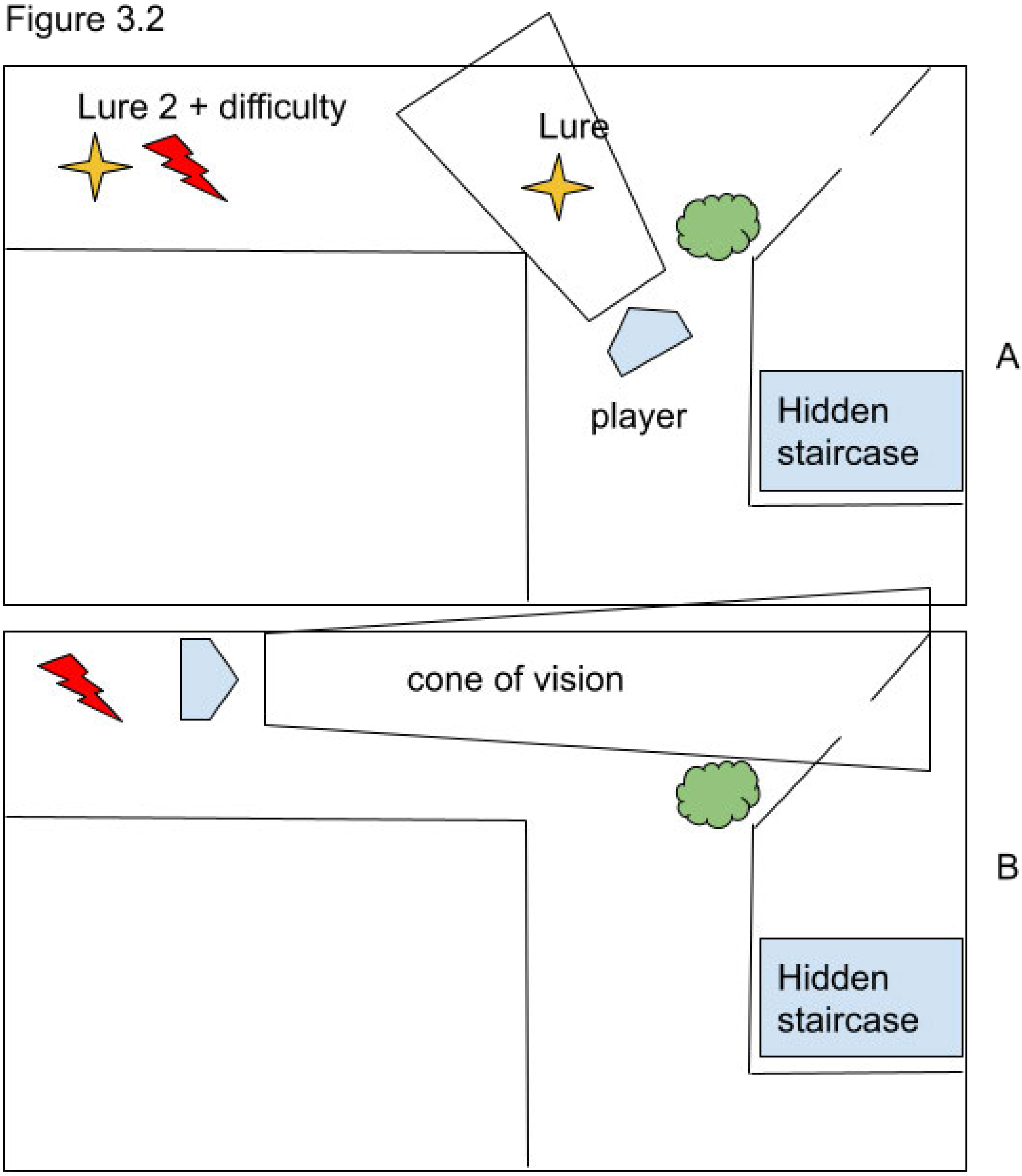
Figure 3.1

On the left a locked door that needs a key to open (hard lock).
On the right a jump requireing the HI-jump boots upgrade in super metroid. It can also be reach by carfully acending with bombs making it a soft lock.

Difficulty Lock:
A lock that requires power or skill to “open”. An example of this would be a boss fight. An important feature to highlight here is that the difficulty may also be overcome through mechanically stronger characters not necessarily player skill. Using this lock allows the designer to filter players by power allowing a more fine-tuned experience concerning the difficulty.

Perspective Lock:
A perspective lock does not directly bar the player from entry but rather “hides” the path from certain viewpoints. They work in tandem with lures. A player that is frustrated with their progress might consider new options, especially if they have already learned that the game has a range of paths to choose from. This is where the perspective lock comes in. While an average player’s attention is guided down the cohesion path through the use of lures, the frustrated player might turn around and investigate new options (see figure 3.2 for an example). As the cohesion path is linear in nature this player traverses the level in reverse allowing for a new perspective to be utilized.

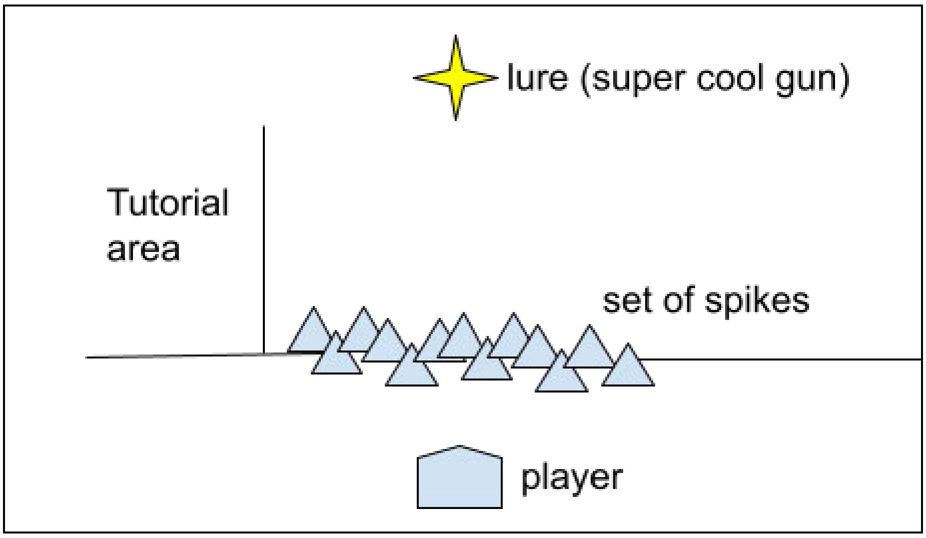
Figure 3.2



In diagram A the player is drawn by the lure. In B the player faced too much difficulty and looking for other options. The path to the hidden starecase is then revealed.

Knowledge Lock:
The knowledge lock bars the player not by use of a game mechanic or difficulty but simply by missing knowledge about the game. The most basic example is a keycode that locks a door. This can be utilized to allow greater variation for recurring playthroughs as the player retains their knowledge. This lock can also be considered a mechanical lock for as long as the player has no knowledge of how to overcome the obstacle it effectively appears like a game mechanic barring entry.

Figure 3.3

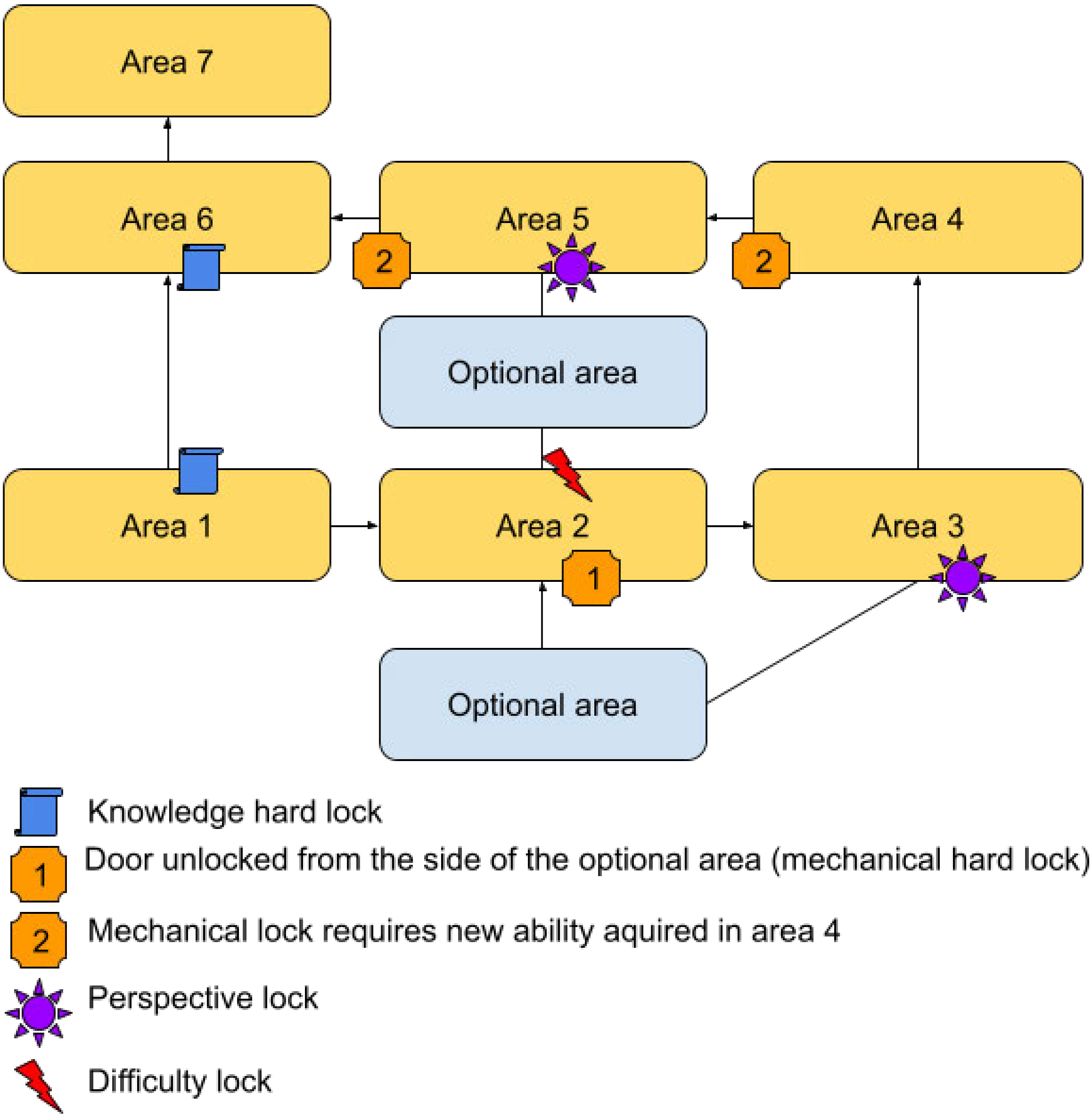


Knowledge soft lock: If the player already knows how to jump he is enticed to jump over to the lure. If not he will enter the tutorial area as the only other option learning basic movement.

Lures:
A lure can be anything that draws the player in. Here it should be noted some lures work on some types of players better than others. Consider **Step 3 - Presented Difficulty**, players that have a high skill level or a desire for difficult challenges will find appeal in these confrontations, while others might not. There should only be a single lure that attracts some kind of player at any given time otherwise, the player behavior will become less predictable.

Know that the different locks are introduced I will go over how they ought to be used (see figure 3.4 as an example). Perspective locks are to be used to block entrances to optional paths. Difficulty locks are to be used to gain access to later parts of the cohesion path early. However, the depth should be limited by mechanical locks. This allows players with a demand for the higher difficulty to be satisfied while at the same time not losing the cohesive element. When the player encounters the mechanical lock they have to return to the cohesion path, here a shortcut might be recommended to avoid backtracking.
Knowledge locks are to be introduced in the same manner as difficulty locks. However, limiting the player with mechanical locks might not be necessary depending on the progress the knowledge implies. If a player can open a gate at the beginning of the game, however doing so requires the knowledge gained from finishing the game, the designer can assume that the player 1) has the proper expectation of the change in experience and 2) has already gone through all tutorialization. This allows for greater player autonomy as the game progresses.

Figure 3.4



This concludes all 5 steps necessary for the level guidance method. In the next chapter, I will analyze games, first of all, to see how the Level Guidance Method can be used as a model to understand non-linear games, and second, to gain insight into the potential validity of the method.

4 Analysis

4.1 Selection

For the analysis to be meaningful games need to be preselected for some criteria. Additionally, the selected games should be of higher quality to see whether or not the Level Guidance Method can be applied to them because the method claims to offer a better experience overall. The selection criteria are as follows:

- Must be Action-Adventure genre
- First or third person
- No procedural generation of levels
- single player viable
- no linear level design
- accessible to the author

The Level Guidance Method as described needs somewhat of a progression path to work. This explains the Action-Adventure genre criteria. It is perfectly possible that other genres would work too, however, Action-Adventure features gameplay that should somewhat guarantee this prerequisite.
The criteria for first or third person is on one hand because perspective locks are easier to implement in those types of games. Other perspectives might be equally valid however I have reduced the scope of this thesis to 3D games.
The other criteria are self-explanatory.

(*Top 250 Best Steam Games – Steam 250*, n.d.) is used to create a list of high-quality games matching the criteria. This list is a combination of the top 250 rated games on steam as well as the top 250 most rated games with a review rating cutoff at 85% positive. In the Left column, are all the games that the author has access to. In the middle column, the list is further reduced by all other criteria. In the right column, the entries of the middle column are sorted by the author's familiarity with the games. The game to be analyzed is selected from the top of the list.

Games accessible to the author	**Games filtered by all other criteria**	**Sorted by author's familiarity**
Portal 2	Witcher 3	Dark Souls remastered*
Portal	Satisfactory	Subnautica
Half-Life 2	Subnautica	Satisfactory
Slime Rancher	Fallout New Vegas	Fallout New Vegas
Witcher 3	A Short Hike	Elden Ring
Satisfactory	Skyrim	Dark Souls 2
Dishonored	Dark Souls 3	Dark Souls 3
Subnautica	Oblivion	Skyrim
Fallout New Vegas	Dark Souls remastered*	Subnatuica Below Zero
Tomb raider	Dark Souls II	A Short Hike
A Short Hike	Elden Ring	Oblivion
Half-Life	Subnautica Below Zero	Witcher 3
Skyrim		
Dark Souls 3		
Oblivion		
Dark Souls remastered*		
Dark souls II		
Elden Ring		
Subnautica Below Zero		
Shadow of the Tomb Raider		
Soma		
Doom		

*Because Dark Souls got a remastered version the rating is split between the original and remastered version. They are however for the purposes of this thesis the same so I will use them interchangeably.

4.2 Deconstruction

There are a couple of things that should be noted before jumping into the analysis. The movement modality of teleportation (as mentioned in chapter 2.1.2.3 Dimension) must be considered when determining the paths that connect areas. Dark Souls features two distinct methods of teleportation. The first teleportation occurs when the player dies and returns to the last bonfire used. Bonfires thus act as a save point so to speak. The player can also use items to achieve the same outcome. The other is unlocked later in the game by obtaining the lord vessel. This allows teleportation from a bonfire to a select list of other bonfires.

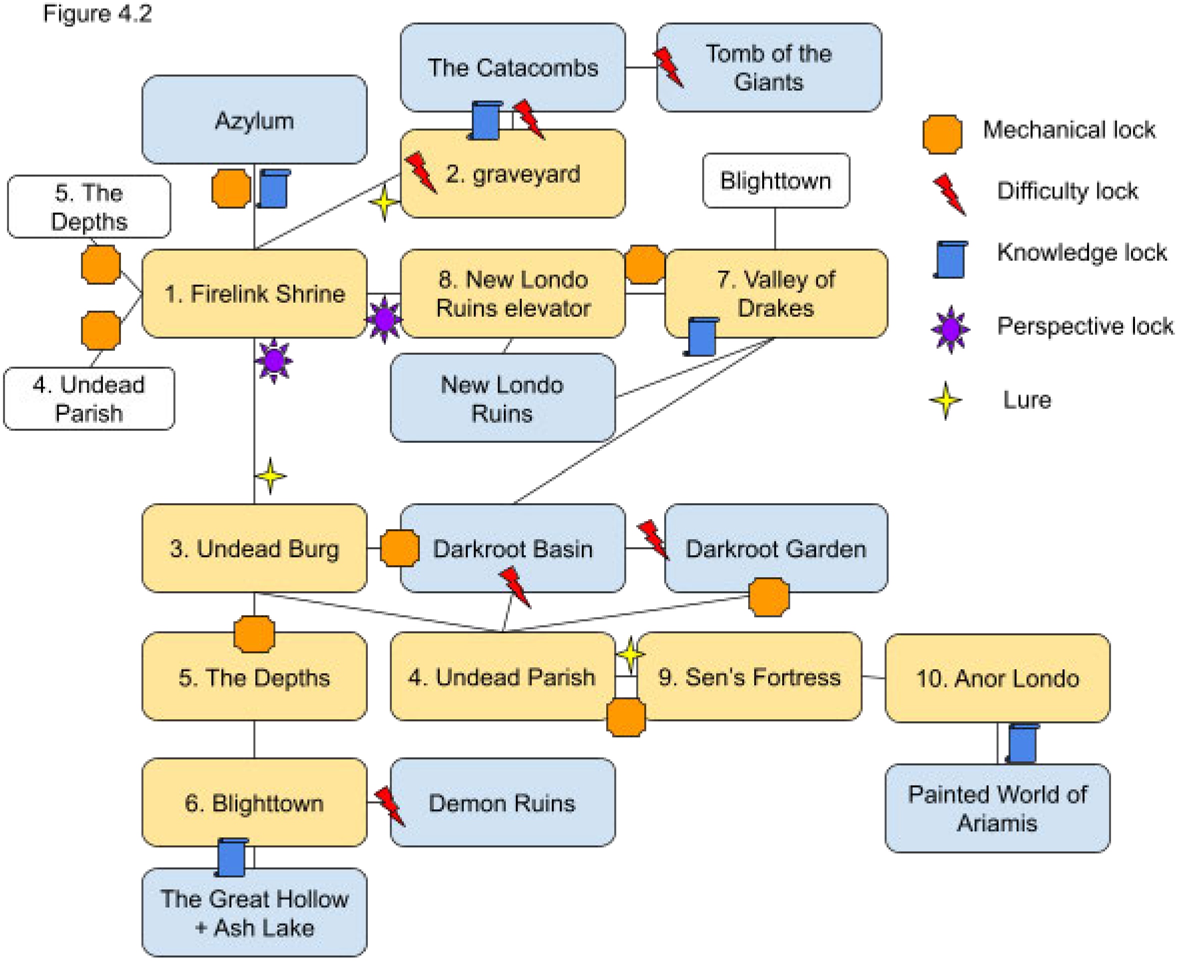
For the assessment of difficulty locks, I will use my subjective judgment. It is in principle possible to derive difficulty from the heath and damage numbers of enemies. This however gets more complicated once the number of different attacks, the attack time, attack arc, and the number of enemies in an encounter are factored in. The “readability” of attacks also place a huge role in the difficulty of enemies and this is rather subjective. I will consider all these variables as objectively as possible, but it should be noted that in the end, it is my subjective judgment of the difficulty.

In the first step, I will split the world into areas and mark the areas that are part of the cohesion path in yellow (see figure 4.1). Since after Anor Londo, the player obtains the ability to teleport and the game has progressed to a point where keeping to the cohesion path is not that useful anymore I will exclude anything beyond this point. I nonetheless want to point out that all of the remaining areas are all endpoints with no interaction with the rest of the world.

Figure 4.1

In the second step, I will arrange the areas not by geographic location but rather by their topological interactions, and to some extent, they are arranged for readability (see figure 4.2). White areas are duplicates for readability purposes only. The cohesion path areas are numbered in the order they are supposed to be traveled.

Figure 4.2



4.3 Discussion

A major difficulty with the analysis is the granularity of areas. I have taken the liberty to roughly describe the areas as they are separated in the game. However, looking at New Londo Ruins it becomes clear that not only do details get lost, but the diagram becomes misleading. I have separated New Londo Ruins and “New Londo Ruins elevator” for this sake. Otherwise, New Londo Ruins need to be considered as part of the cohesion path, however, the player never needs to enter the area properly as the Valley of Drake entrance and the elevator to Firelink Shrine is right next to each other.

Furthermore, I come to the conclusion that oftentimes locks require a much more granular approach to fully capture their effect. In contrast, a high-level view helps to understand the frequency and relation of optional paths. This might get lost in the details of a more granular approach.

When looking at the locks it can be observed that the knowledge locks are rarely used to skip in the cohesion path as I suggested in figure 3.4. The only time this is applied is in New Londo Ruins to Valley of Drakes. On the other hand, they are often used to bar entry to optional areas and it is to be noted that these areas are all dead ends.
Mechanical locks are used throughout the game. Most of the locks are simply doors open from one side to connect a new area to an old one. The most notable mechanical locks are between Valley of Drakes - New Londo elevator and Undead Burg - Darkroot Basin. These locks are doors requiring their respective key, however, depending on the choices of the player at character creation they can option the master key that can open both.
Perspective locks suffer from the granularity of the analysis. There are two at the onset of the game. The first hides the true path forward to the Undead Burg and is not used as suggested in chapter 3.3 to link to an optional area but rather to send the player to the graveyard first. This however still matches the intention of **Step 3 - Presented Difficulty** of the Level Guidance Method. The other perspective lock serves the predicted purpose and hides an optional area for the player. Here the player can find the first blacksmith and upgrade his character to ease their progression.
The difficulty locks are implemented as predicted. They are presented throughout the game and there is always an obvious way to progress without engaging with them. They also don’t allow any skips on the cohesion path.
Generally, the locks and areas are connected in such a way that the player has always encountered them before having the opportunity to open them, allowing them to build a cognitive map beforehand. We can see a good example of this between Undead Burg and The Depths. Here the player encounters the door long before the key is acquired in Undead Parish. The locks between Firelink Shrine - Undead Parish and Firelink Shrine - The Depths have been encountered before in a way that is unavoidable.

5 Conclusion

I have presented the Level Guidance Method as a tool to understand, design, and evaluate non-linear games. It leverages the difference in perspective of player types and the changing nature of player motivation. This way the player can enjoy a more tailored experience while offering the designer a tool to get a handle on the complexity of non-linear worlds.
The analysis of the method shows a weakness in the method as it offers no mechanism to decide on the granularity of the analysis. Using the method as a model for non-linear games only works in specific cases where the game has a somewhat linear progression. The method currently offers no way to understand how many optional branches a level should have or in what intervals they should appear.
The analysis of chapter four can by no means validate the method for its implied effects. For further research purposes, however, a quantitive study can be conducted. By designing a game following the method and collecting data on player movement and following this test with a questionnaire a deeper insight into the validity of the method can be acquired.

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Sven Dettmers