Problem Solving: The Essence of Player Action in Computer Games

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ABSTRACT
This paper will present the major findings of the author's hovedfag (M.A.) thesis [1], which investigates how the player engages in the structuring of courses of action in computer games. Since the player's engagement may be said to be a problem solving process, this paper presents a scheme of problem solving in modern computer games that proposes the concept of computer game agency. The scheme will be illustrated by examples from the computer role-playing game *Baldur's Gate II*, and the turn-based strategy game *Heroes of Might & Magic IV*.

Keywords
Action, problem solving, computer game agency, aporia & epiphany, *Baldur's Gate II*, *Heroes of Might & Magic IV*.

INTRODUCTION

Any game has problems that need to be solved. And players that need to solve them. Otherwise, the progression of the game comes to a halt. This paper will present a general scheme illustrating how this problem solving process goes on in modern day computer games. It is a process very much in touch with cognitive psychology's step-by-step problem solving, in that it starts with the comprehension of a problem that is the player's to solve, and develops into intentional player action that seeks to solve the problem. Focussing on games as environments of problem solving, this paper sees the relationship between the game and the player as one where the game throws problems in front of the player, and the player reacts by trying to solve the problems in order to progress in the game. This interplay between game and player is the primary prerequisite for the progression of the game. When the player is able to solve the problems by finding solutions and executing them and thus initiate game progression, this is an example of *computer game agency*.

Computer game agency is the central concept in this paper, which will outline a problem solving scheme of how this kind of agency is manifested in modern computer games. After presenting the scheme, I will use it as a tool to examine the player's progression through sample sequences of the computer role-

playing game (CRPG) *Baldur's Gate II* (*BGII*)[2], and the turn-based strategy game (TBS) *Heroes of Might & Magic IV* (*HoMMIV*)[3].

THE CONCEPT OF AGENCY

Agency is a concept adapted from the philosophical *action theory*, which focuses on how it comes about that an individual decides to take actions and how s/he executes them. The concept of agency stresses the important fact that actions are taken by *agents*, who are rational and conscious individuals. For an action to be labelled agency, however, it must be intentional, meaningful and have a certain effect, but the effect does not need to be expected [4].

Brenda Laurel and Janet Murray introduced the concept of agency to the studies of computer games and 'participatory narratives'. Laurel defines agency as 'the power to take action' [5], while Murray specifies the concept further and claims it is the feeling that one has an effect on a system, and that agency thus is more than participation alone [6]. However, Laurel and Murray's simplified versions of agency are not powerful enough to describe how agency actually works when related to computer games. As a matter of fact, neither is the view of action theory, since it is based upon how people act in the physical environment in which we live and not in some artificial environment designed for certain behaviour. We need a specially designed concept of *computer game agency*, and that is exactly what this paper seeks to do.

When one plays a computer game, or any other game for that matter, one takes on a very special role of activity that is quite different from that of the appreciator of for instance films and literature. It is possible to separate three levels of participation when describing how a work may be traversed. *Activity* is the lowest level, and it is present whenever one meets a work of any kind. It includes both physical and mental phenomena, and may be exemplified by the turning of pages when one reads a novel, or the mental activity at work when interpreting and making hypotheses. Thus, it is a prerequisite for all kinds of activity, participation and comprehension. The next level is *action*: all physical player actions that are meaningful, and under some respect consciously taken. Examples are exploration, manipulation, modification, configuration – important actions that may or may not have an impact upon the game environment, but that do not themselves necessarily *progress the course of action* in the game.

Neither activity nor action has the power to progress the work the way *agency* has. As action theory suggests, agency must also have a certain *effect*, and this fact is implied by neither activity nor action. When it is specified that an action has the effect of progressing the course of action in a game we may label this action agency. It is thus the *situation* in which the action is taken that decides whether an action is labelled agency or not.

Problem Solving

Since agency is the power to progress the course of action in a game, it is obvious that it is important to problem solving. When the player plays a computer game, s/he solves the problems s/he meets by taking actions of the agency type. But how does this process of problem solving go on in computer games?

We may say that the player *exchanges aporias with epiphanies*. According to Espen Aarseth, an aporia in a computer game is a clearly defined problem that the player meets when playing a game. In his words, it is a '"roadblock" that must be overcome by an unknown combination of actions'. When overcome, the aporia is replaced by an epiphany, which is a sudden and often unexpected solution to the aporia. In order to explain, Aarseth gives an example from *Doom*: the player enters a room filled with monsters. After several attempts of shooting them and running around them, s/he realizes that there is an aporia: how to get past the monsters. This aporia may only be overcome by a very special epiphany: in the other end of the room there are several barrels that explode if fired at. Doing this, the player is able to kill all monsters and continue unharmed [7]. However, this epiphany does not need to come as a sudden revelation, and neither does any other epiphany in any other computer game. As Aarseth points out, experienced players may suspect that there is such a solution; thus, the epiphany does not come as a surprise. The player always has hypotheses about what the epiphany may be, and to have a correct hypotheses about the epiphany is often simple, while *how to execute it* may not be as simple.

Anyway, taking Aarseth's view as a point of departure, we may say that when a player meets a problem in computer games, s/he meets an *aporia*. This is a clearly defined problem that the player must solve in order to be able to progress in the game. When the player comprehends what is the solution, s/he has found the *epiphany*. This may come as a sudden revelation, or the player may have hypotheses about it immediately after the aporia is comprehended. In many modern computer games there may even be several different, but mutually exclusive, epiphanies. In order to progress in a game, the epiphany must be executed.

However, an epiphany that comes as a sudden revelation reminds us of what cognitive psychology labels *sudden problem solving*. Here the solution is not immediately seen but comes unexpectedly after a mental restructuring of the problem. However, in a traditional quest situation when the epiphany is easily hypothesized, and it seems that the real difficulty is to reach the state when it is possible to execute the epiphany, we are concerned with cognitive psychology's *step-by-step problem solving*: The problem solver must get an overview of the situation by describing the solution as a series of instructions that must be executed by the use of a strategy.

So we may distinguish two main modes of problem solving in computer games; but for the purpose of keeping the terminology separate from that of everyday life I prefer to use the words *aporia* and *epiphany* instead of problem and solution. However, it must be kept in mind that epiphanies do not need to come surprisingly.

A Model of Problem Solving

Let us now use the terms agency, aporia and epiphany to set up a scheme of how the whole process of problem solving may be described. There are several different phases that may be identified and that any player goes through when engaging in the progression of a game. The scheme covers Aarseth's example of how a player comprehends an aporia and later realizes its epiphany, but it also visualizes how action theory claims that rational individuals take actions.

We may say that there are two 'paths' the player may take in the course of solving problems in computer games. One path is correct, in the sense that it solves the problem in question, or takes the player from the comprehension of the aporia to execution of the epiphany. The other is faulty, which means that the problem is not solved. In the following both processes will be described.

When the player plays a computer game s/he will meet different problems. These may be either very consciously written into the game's source code by the designers, or they may be *emergent* by appearing unpredictably as a result of the combination of rules and variables [8]. When the player meets a problem his/her first task is to *comprehend this aporia*. This is by no means a physical action, but it must be regarded an activity, and it is the player's first mental step of preparing for intentional action. It is an essential prerequisite for agency, although it cannot alone be labelled agency.

After the player has comprehended the aporia, s/he meets a second mental task: *the development of a strategy*. This works as a link between mere comprehensive activity and physical action, since the player knows the strategy is developed as a tool for his/her own actions. However, there are many features that affect how the strategy is formed. It is likely that the player has hypotheses and beliefs about what is the epiphany, and how to reach it. In addition, knowledge about features such as the specific game, the genre, the situation, the opponent, and about constraints in the interface and the environment will also affect the strategy. Not at least, the opponent's moves are of great importance to the player's choice of strategy. It is important to note that developing a strategy seldom is a conscious process. It is also somewhat artificial to situate it at this point in the problem solving process since a strategy often is developed during the course of action, and is not a phase of its own within the process.

Intentional action is the third phase, where the player's mental activity is realized as physical attempts to solve the problems. Intentional action may lead to the execution of the epiphany, and as the problem is solved the player progresses in the game and is taken to the next aporia and one step ahead towards completing the game. When the player takes intentional action that executes the epiphany, s/he takes an action under the label of computer game agency. However, following the faulty path of the scheme, intentional action may also lead to *quasi-causes*, which, when executed, lead to no effect or an effect that is not wanted. The reason for this may be that the player had wrong hypotheses about what the epiphany was or s/he may have misunderstood the aporia; or s/he may simply have had a bad strategy or the attempt was bad. In any case, s/he will have to go back a certain number of steps in the problem solving process. If the aporia was misunderstood or the player had wrong hypotheses about the epiphany, s/he must rethink what is the actual problem. If the strategy was unsuitable, it should be redeveloped; or if the attempt was bad, the player should try again. Unwanted effects may be dealt with in several ways. Either the player tries until success or until s/he runs out of patience, or s/he loads a previously saved game. S/he may also quit the game.

Image 1: A model of computer game problem solving.

We see then that player action in computer games takes the form of problem solving. Player action is based upon a strategy that comes into being as a result of an interplay between the game layout, the player's knowledge and beliefs, and the moves of a human or computer opponent. A satisfying strategy solves the aporia and lets the player act according to the epiphany. And it is the execution of the correct epiphany that causes the game to progress. This is the effect that I call computer game agency: an action with the effect that it *takes the player a step further in the problem solving process*, ideally by *solving an aporia and executing the epiphany*.

THE CHINESE BOX AND THE TREASURE HUNT

To demonstrate the theoretical views above, I will give examples from the CRPG *Baldur's Gate II* and the TBS *Heroes of Might & Magic IV*. These games are very different indeed, at least concerning how the player interacts with the game environment. In short, we may say in Jesper Juul's words that *BGII* is a *game of progression*, while *HoMMIV* is a *game of emergence* [9]. *BGII* is built around the quest paradigm derived from typical 'story-games' such as *Dungeons & Dragons* and other table-top role-playing games. What happens in the game is very much up to the game designers, who to a great degree may 'railroad' the player through the game. There are certain nodes that must be visited in order to progress in the game, and the course of action becomes thus quite determinate. The game structure is that of a *staircase*, where one aporia-epiphany pair central to the main path of progression occupies each step. The aporia-epiphany pair on the present step must be fulfilled before the player is allowed to go on to the next step. Thus, the player must concentrate on one problem at a time in the central problem solving process, and replacing an aporia with an epiphany on one step is a case of computer game agency since it takes the player one step further towards completing the game.

HoMMIV, on the other hand, has rules and variables that are combined to form a less predictable event structure. The progression towards the goal relies much more heavily upon the player's own strategy than upon the different steps that a game of progression expects the player to go through. Thus, there is no clear, predefined path that the player must traverse, although there are certain phases of strategic action: a first phase of collecting resources, a second phase of developing forces, and third phase of conquering. It seems thus that computer game agency in *BGII* is centred around successive aporia-epiphany pairs, while in *HoMMIV* it is centred on different types of strategic action which defines the different phases.

As we understand from the genres that the two games are said to belong to, the problem solving in *BGII* is focused on role-play, while in *HoMMIV* problem

solving is focused on strategy. It is important in *BGII* that the player takes actions that the game character would take in the given situation. The player must let the character come to life by letting its motivations and intentions dominate, while the player's own personality and strategic choices are set aside. As a matter of fact, there are certain features in the game that restrict the player from taking many actions that are not related to the character's personality. In *HoMMIV*, on the other hand, the characters are only pawns with certain abilities, and gameplay is not dependent upon how the player chooses to play the character. Here all moves are related to the goal of the game, and all the choices the player makes in order to come closer to this goal. It becomes crucial to develop a strategy for reaching the goal, and game design opens up for this by letting the player be in control of kingdom development and resources.

In *HoMMIV*, the goal of the game is specified at the very beginning of every scenario: 'defeat all enemies', 'capture [name of city]', or 'find [name of artifact]'. This feature makes it possible for the player to make long-term plans of action and thus develop a strategy. Although the player may have other more urgent problems in mind, these are always seen in context with the main goal of the game, since every move affects the player's situation later in the game. This is very different from *BGII*, where the goal is never specified, but is understood little by little during the course of the game. Here the goal changes as different events and pre-programmed opponent actions make the situation more complex than first believed. It is therefore difficult to plan a certain strategy of action, and the player thus concentrates on one problem at a time instead.

HoMMIV lets the player traverse the game by the means of a very traditional step-by-step problem solving structure. The player must understand that long term planning is valuable, and that several actions must be taken before the central epiphany may be executed. To know what is the epiphany is not the strenous task; rather, what is strenous is to calmly execute an efficient strategy. It is possible to say that *BGII* also relies on some kind of step-by-step problem solving, since the player is asked to finish one task before being allowed to go on to the next step in the progression towards winning the game. However, the player does not need to have a central aporia or epiphany in mind – what counts is the *situation* in which the player finds him/herself at any given moment. *BGII* presents the player to some kind of quest or event that s/he must concentrate on and solve: there may be *quests related to the central problem solving process*, or *quests with no or a remote relation* to the central problem solving process. Those with a remote relation may be freely taken on by the player, or they may be thrown upon the player. In addition there are *events*: sudden problematic situations that the player must take care of immediately, such as ambushs.

Case Studies: Sample Sequences

After having established a model of problem solving in computer games, let us now see how problem solving actually may happen in *BGII* and *HoMMIV*. I will give specific examples from one episode from each of the game, where I identify the different phases from the model outlined above.

Baldur's Gate II: The Guild War

Early in *BGII*, the player is in search for the evil wizard Irenicus. Not only did he held the player character and his/her friends captive in a dungeon from which they just escaped; Irenicus recently also kidnapped one of the player character's friends. Now the group finds itself in a city, motivated to track Irenicus down. The aporia appears to be how to find the missing character and Irenicus, but the epiphany is unclear. Without knowing the epiphany, the player is likely to start exploring and asking people about information in order to increase knowledge about the situation. However, when the group enters the part of the city known as The Slums, a thief named Gaelan Bayle approaches them and his suggestion clarifies the epiphany: for the amount of 20,000 gold he will lead them to someone who may help them getting to where Irenicus and the missing character are. The epiphany of finding them is thus collecting the money. Gaelan Bayle's offer also changes the player's comprehension of the aporia-epiphany pair. The correct aporia here is how to collect 20,000 gold, and as Gaelan Bayle suggests, the epiphany may be taking on missions for payment. Thus, the player sets aside the thought about finding Irenicus and Imoen, and gets a new focus as a new aporia-epiphany pair suddenly appears as much more urgent: finding someone who wants to pay the group for different sorts of duties.

Having collected the money for the thief, the group is led to the thieves' guild leader, who wants to check if the group is reliable before helping them finding Irenicus and the missing character. He sends them on several missions, and the group is suddenly part of a conflict between the city's two thieves' guilds. This leads to a phase that reminds us of a treasure hunt where the characters appear as a group of errand boys, and the player is again forced to concentrate on another aporia-epiphany pair than the one s/he originally focussed on. This sequence consists of several aporia-epiphany pairs linked successively together. First the thieves' leader asks the characters to help the thief Mook unloading a ship at the docks. The aporia and the epiphany are not clear, but the player expects to have them clarified at the docks. Here, the group suddenly meets an aporia when Mook is attacked by an assasin: protect Mook and the cargo. The epiphany seems to be fighting the assasin, but before the player is able to do much harm, the assasin kills Mook and disappears. The player may believe s/he has failed the mission, but on returning to the guild leader, the group receives another mission: preventing more thieves from leaving the guild. After accomplishing this mission's aporia-epiphany pair, the group is supposed to clear out the hiding place of the thieves' arch enemies, the vampires. This is the last of three successive aporia-epiphany pairs that the player must go through before being allowed passage to the island where Irenicus helds the missing character captive.

This sequence exemplifies how aporia-epiphany pairs are linked in a successive chain, where a new aporia is not revealed until the epiphany of the preceding aporia is executed. Thus, it is hard to identify a single aporia-epiphany pair in this sequence since the characters take on the role as a group of errand boys who accomplish their master's task without knowing what comes next. Also, the player is forced to concentrate on one aporia-epiphany pair at a time, while the main problem solving process of finding Irenicus and the missing character is kept in the background.

Although all aporia-epiphany pairs in this sequence are somehow related, it seems that they must be solved as individual problem solving processes with

no strong strategic connection to each other. We may therefore say that this game relies more on *situational tactics* than on a *general strategy*. Since *BGII* does not initially reveal what is the goal of the game, it is not possible for the player to keep the central goal in mind and base his/her actions on this knowledge. Developing a strategy or planning the course of actions is therefore difficult in this game. All actions must instead be regarded connected to the specific aporia-epiphany pair in which the player is involved at the moment.

To the extent we may speak of strategic choices, these are connected to an all-over playing style, for instance a tendency to solve problems through violence or negotiation. From the short analysis above, it is clear that traversing *BGII* is a problem solving process that is solved through going through a chain of preconstructed aporia-epiphany pairs. Each aporia-epiphany pair must be given the player's full attention, and other problems must be set aside and temporarily forgotten. This creates a playing style centred on going along with the flow. Although the game designers have decided the player's path of actions, the game does not become a guided trip for tourists. Instead the game becomes a *treasure hunt*, where the participants solve a riddle at one place, and based on the knowledge gained they are able to continue their hunt.

Heroes of Might & Magic IV: The Gathering Storm: Isle of the Dawn

The sample sequence from *HoMMIV* is taken from the *Gathering Storm* expansion campaign *Isle of the Dawn*. At once starting to play this campaign scenario, the player receives an initial on-screen message - apparently from the hero's diary - that says the hero should hurry to the city of Davenport to meet a governor and tell him about the search for an artifact called the Mandolin. Thus, the player is immediately made aware of the aporia, which is to get to Davenport. Since this is made very clear by the on-screen message, the player comprehends it immediately. That the player's hero also finds him/herself extremely vulnerable at the start by having neither a protective army nor a resource-gaining city, only adds as a motivation to get to Davenport. However, as the epiphany is not specified, the player will make hypotheses about what it may be and develop a strategy of some kind. One hypotheses that is very likely to come into the player's mind is that finding Davenport is related to exploration, and the player starts moving his/her hero around.

Upon exploring the environment, the player suddenly notices that unlike most scenarios and campaigns, the hero is able to sneak past monsters guarding different treasures. The hero obviously has a very good stealth skill! This discovery increases the player's knowledge about what actions the hero may take, and it may lead to the hypothesis that getting to Davenport involves stealth. On the eighth turn the player gets another on-screen message that increases his/her knowledge and confirms this hypothesis:

> The way [to Davenport] is guarded by a group of thunderbirds; I need to find a way to sneak past them. I wonder if anyone here will assist me (…)? Rumors have started about a skeletal army to the northwest (…) I need to get to Davenport as soon as possible.

This message clarifies both the aporia and the epiphany: now the *goal* is to get to Davenport, while the *aporia* is how to sneak past the thunderbirds. There are also clear hints that the epiphany is connected to getting someone to help the hero sneak past the birds. However, the player may believe that the hero's stealth skill is already good enough for sneaking past, but approaching the

thunderbirds, s/he finds out that is not the case. Attacking the birds also leads to disaster since thunderbirds are some of the most powerful monsters in the game. Also, the player may have a hypothesis that there may be a powerful army or hero somewhere that may help the hero crush the thunderbirds. At this point this is only speculations, so further exploration is necessary.

However, a strategy may now start to form in the player's mind, since there are several features that need to be connected. Goals are specified, the aporia is fairly clear, and the epiphany has become limited to a few alternatives. In addition, the player knows that s/he needs to find Davenport very soon, thus *speed* is a strategic feature. Also, finding this someone who may help the hero sneak past the thunderbirds is crucial. The strategy is related to how the player finds best to connect these features in the problem solving process in order to reach the goal and solve the aporia by executing the correct epiphany.

The correct epiphany is soon discovered as the player keeps exploring. A quest hut that demands 20 of each resource in order to teach the hero *Grandmaster Stealth* reveals that the epiphany actually *is* utilizing the stealth skill to get past the thunderbirds. Although now the player faces another aporia: finding 20 of each resource. The epiphany is easy to see, since the aporia may be solved by collecting the resources, trading them, or a combination of both. Exploration is crucial regardless which one the player chooses. After accomplishing this, s/he goes back to the quest hut to deliver the resources and collect the reward. Delivering the resources, the player has solved the aporia-epiphany pair that involved collecting 20 of each resource; and collecting the reward of learning *Grandmaster Stealth*, the player has reached the epiphany of getting past the thunderbirds. When this epiphany is executed, there is only one epiphany left, namely reaching Davenport. However, this is easier than the player may have suspected. The city is unoccupied, and the hero may walk straight into it in order to accomplish the main aporia-epiphany pair in this sequence.

This short analysis emphasises that aporia-epiphany pairs in *HoMMIV* are complex. We could say that each pair is superseded by the next, but this would not catch the dynamics of problem solving in this game. Aporia-epiphany pairs in *HoMMIV* instead seem to be *contained within each other* like a Chinese box or a Russian doll. As the sequence above shows, a new problem turns up internal to another one and must be completely solved before the first one is solved. This means that the epiphany of one aporia is not executed before a second aporia turns up. The problems contained within each other are also *directly* linked, since the player's strategic choices in one aporia-epiphany pair also has consequences for the next. Since the goal is specified at the start of the game, the player is able to see all his/her actions in the light of the goal, and this is what makes it possible to understand the consequences of player actions and develop a far-fetched strategy. Planning ahead is therefore essential in this game.

Another interesting feature in the analysis is the epiphanies. In this sample, we see that the aporia needed a much more complex epiphany than first hypothesised. The player may have believed that the epiphany of reaching Davenport was connected to exploration and conquering the defending armies of the city, but instead s/he had to explore, find someone who could help him/her, collect resources and increase the hero's stealth skill. Also, the epiphanies are not too different from Aarseth's suggestion of a suddenly appearing solution. Actually the player only has hypotheses about what they

might be, but when s/he at last realizes what they really are this often comes as a surprise.

CONCLUSIONS

As a general remark, we may say that the player engages in the structuring of courses of action in computer games by the means of problem solving. Traversing a computer game is dependent upon some kind of physical activity that may be described under the term *problem solving*. When the player is able to solve an aporia by executing the correct epiphany and thus make the game progress towards a new state, we call the action a case of *computer game agency*. It is thus not the action itself, but its effect and the situation in which it is taken that decides whether or not we are dealing with agency. Agency is one of the defining features of computer games, since it acknowledges the specificity of the role of the computer game player.

We also observe some differences between the game genres concerning the process of problem solving. Although both the CRPG *Baldur's Gate II* and the TBS *Heroes of Might & Magic IV* both rely on a form of step-by-step problem solving, the two logics are still not quite the same. It seems thus that games of progression and games of emergence have different ways of realizing the problem solving process. By arranging nodes that the player must reach in a certain order, games of progression may conceal what is the goal of the game and thus focus the player on one problem at a time with no urgent need to develop a strategy. The problem solving process then reminds us of a *treasure hunt*, where the problem solving is arranged around a staircase structure. The player must concentrate on the aporia-epiphany pair on the present step, while the central problem solving process of the game is forgotten. Games of emergence may present the goal intially in the game in order to provoke the player to create a strategy and thus be an active part in the process of emergence. When the player from the start knows what is the goal of the game, it is possible for the player to plan ahead, and see every action s/he takes in context with the goal.

It should also be noted that *BGII* is characterized by successive aporia-epiphany pairs where one aporia-epiphany pair must be solved before going onto the next. The player is focused upon taking one problem at the time by the fact that the next aporia in the central problem solving process will not appear until the preceding epiphany is executed. Thus, this is different from *HoMMIV*, where a second aporia often appears before the first epiphany is executed.

The analysis also reveals that it is not always figuring out what is the correct epiphany that is the difficult task; often the epiphany is obvious while it is hard to find out how to execute it. This suggests that the actual process of problem solving may appear either before or after the epiphany is understood. This demonstrates different methods of problem solving, but it does not demonstrate the difference between step-by-step and sudden problem solving. Although sudden problem solving always seems to place the problem solving process *before* the epiphany, step-by-step problem solving may have the process both before and after the epiphany.

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