Self-Referentiality in Computer Games: A Formalistic Approach

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Introduction

As the title indicates, this chapter locates and discusses self-referentiality in computer games using primarily a formalistic approach. I shall argue that computer games can be self-referential in, at least, a triple sense: On a *fictional* or *content* level games often refer to other games or other types of media. The monsters in *Doom 3* pay tribute to the original scary polygon creatures in *Doom*; villains and good guys in *Grand Theft Auto: San Andreas* refer more or less to actual, present-day characters in mass mediated pop culture; and plots and key actors in *Myst IV: Revelation* fit nicely into the overall cosmology of the much celebrated adventure game *Myst*.

However, if we move beyond the sphere of narrative, plot, and vast game worlds, we find that computer games in themselves, on a *structural* or *formal level*, are self-referential as an inherent part of their ontology. To put it bluntly: games are games because they are fundamentally self-referential. To eliminate or fail to recognize this highly specific – and, to a large extent, technological and scientific – feature of computer games is to ignore the invariant base of the computer medium. This is intimately correlated with the important concept of *recursivity* (Nöth 2005), which explains computer games as mutually dependent linear and circular systems, and it also alludes to the fact that all games are temporal, dynamic systems that evolve around, among other things, the tension between rules and strategies. In the following, the undertaking is first and foremost to investigate this innate feature of self-referentiality in computer games.[1] My theoretical method derives from economic game theory, computer science, and systems theory.

The chapter is divided into three parts. The first part defines and discusses the core entities of any game, namely rules, strategies, and interaction patterns. Section two examines how and to what extent computer games can be labeled complex, dynamic systems. I argue that gaming is a higher-level activity that incorporates the act of playing – hence the term 'game-play – into its very structure. The theoretical corpus of section two draws on some of my previous work on the philosophy of games (Walther 2003). According to Espen Aarseth (Aarseth 2003), there are three components of games in virtual environments:

Gameplay is about the player's actions, strategies, and motives; *game structure* contains the rules, including simulation rules and physics; and *game world* includes fictional content, level design, textures, etc. This article covers all three aspects, as they are intimately interwoven; however, special emphasis will be on game structure. Thus, I begin with defining the ontology or 'game-ness' of games, and proceed with explaining the epistemology of games (and play) by zeroing in on the distinctiveness of gameplay. Finally, the third part sets out to illuminate the level of self-referentiality or recursivity in computer games by tentatively paying attention to the relationship between rules and game world.

Before we embark on our formal journey into the heart of games, it should not go unnoticed that games are clearly self-referential also on a more broad *cultural* level.[2] This is the third sense of self-reference in computer games. Not only do games point to other, specific games while borrowing themes, characters, plot, and back-stories. As modern leisure artifacts and carriers of intellectual value they further subscribe to a wide-ranging *bricolage* culture in which texts, images, motion pictures, games, commercials, and brands cite each other in a rapid pace. This citation praxis arises horizontally through the instantaneous replication across the borders of various current media, and vertically through the re-shaping of 'old' media. The former mode of citation could be called *transmediality* while the latter may be referred to as *remediation* (Bolter and Grusin, 1999; Walther 2005a).

A nice example of this dual mode of cultural self-referentiality in the present-day media landscape is the television series *24* by the American Fox channel starring Kiefer Sutherland. Clearly, the series point towards a number of "classic" issues and plot configurations imported from the history of television drama and cinematic entertainment. This is remediation, old media re-thought, re-configured, and, in a sense, made new again. In addition, however, *24* tells the story of the way in which new media (TV, web, games, chat, etc.) 'speak' to each other, along a synchronous axis, constantly pushing and blurring the demarcations that used to define the specificity of media and their contents, hence offering a rich platform for the user's cut-paste-and-consume approach to media (Walther, 2005b). This, then, is transmediality.

To conclude partially, computer games are self-referential in three ways:

1) *Content self-referentiality*: Games refer to other content matter or fictional elements in games and (new) media.
2) *Formal self-referentiality*: The dynamic of recursivity is part of the genuine, formal nature of games.
3) *Cultural self-referentiality*: Games can be self-referential as they point to a surrounding culture of transmediality.

Rules, strategies, and interaction

Economic game theory is a set of mathematical methods of decision-making in which a competitive, 'risky' situation is analyzed to determine the optimal course of action for a 'player'. According to John von Neumann and Oscar Morgenstern who established the academic field a game consists of a set of rules governing a competitive situation in which from two to *n* individuals or groups of individuals choose strategies designed to maximize their own winnings or to minimize their opponent's winnings. The rules specify the possible actions for each player, the amount of information received by each as play progresses, and the amounts won or lost in various situations. Von Neumann and Morgenstern restricted their attention to games in which no player can gain except at another's expense (so-called zero-sum games).

Later, John F. Nash revolutionized game theory by proving that in noncooperative games there exist sets of optimal strategies (so-called Nash equilibria) used by the players in a game such that no player can benefit by unilaterally changing his or her strategy if the strategies of the other players remain unchanged (Nash 1997).

Drawing on economic game theory we can define games as complex, rule-based interaction systems consisting of three key mechanisms:

- absolute *rules*,
- contingent *strategies*, and
- possible *interaction patterns*.

Game rules are *absolute* in the sense that while the players may question the rationality of the rules at hand, they are still obliged to follow them, to 'play by the rules'. Rules are therefore absolute commands (Neumann & Morgenstern 1953). They are unquestionable imperatives, and they transcend semantic topics, cultural signification, moral agendas, etc. This does not, incidentally, exclude the fact that game rules are *discussed* within a cultural or ethical milieu.

Contrary to rules, strategies are *contingent*, or non-absolute entities, since they count as the more or less detailed plans for the execution of turns, choices, and actions in the game. As such, other strategies that the ones actually carried out could have been outlined and performed. Whether in the shape of short-term tactics or long-term schemes strategies are contingent. In economic game theory, a strategy is an overall plan for how to act in the assembly of different states that the game may be in (Juul 2004: 56), and game theory studies the affiliation between rules and strategic behavior in competitive situations (Heide Smith 2005).

Finally, interaction patterns are the moves and choices that become part of the game while being played thus interfering with the restrictions and options of the game. As the implementation of game strategies tend to cluster in selected regions of the game's possibility space (in order to approximate what in game theory is known as the 'dominant strategy') forming a path through the game space, we may even insinuate that the interaction patterns, taken as a whole, *are* the game itself – especially if we view it from the perspective of the player (Holland 1998). Interaction patterns are the *possible*, as opposed to necessary, combinations or emergent outcome of rules and strategies.

This differentiation can be listed even shorter:

- Rules are *commands*.
- Strategies are *plans* for game executions.
- Interactions patterns define the actual *path* through the game and specify the topography of human-computer (or player vs. rule) dynamics.

Clearly, the interaction patterns work as 'middle ground' as they occupy a domain located between the machine that upholds the rules (the computer) and the human player who has to find and optimize the best way to accomplish the goal of the strategy.

Illustration 1: The relation between rules, interaction patterns, and strategies.

The notion of *gameplay*, which we shall pursue in depth in the subsequent section, involves all three levels of a game, which also explains the difficulty in defining the concept properly. Gameplay is the actualization of a specific stratification of rules, strategies, and interactions, as well as the realization of a certain amalgamation of commands, plans, and paths. For a player, a successful gameplay means a delicate balance between knowing the rules and mapping one's strategy in accordance with both rules and the possible actions of opponents. Games should be equally challenging and rewarding, hovering between boredom and anxiety hereby assuring a space of flow through the network of choices. For a computerized game system, a successful gameplay implies a balance between fixed rules and the control of player input in variable settings.

Rule system and interaction system

What defines a rule? A rule, being algorithmic in its core design, consists of a simple, unequivocal sentence, e.g. 'you are not allowed to use hands while the ball is on the pitch'. Hereby, a rule constitutes the possibility space of a game by clearly stating limitations (not use hands) as well as opportunities (the ball is on the pitch). It is always possible to define a game both in negative and positive terms: rules limit actions; they determine the range of choices in the possibility space; they encircle the arenas to be played in; yet they also frame what *can* be done.

At this point, I am speaking of *all* games, i.e. both traditional games, including sports, and computer games. *Heroes of Might and Magic* rests on rules that are stored in and processed by a computer, and chess or *Monopoly* rely on rules. These latter rules, however, are not accumulated in the database and algorithms of a computer but, rather, written down on paper and stored in the players' head during play, or they can be administered by, say, a referee in a game of soccer. Implicit rules that are normally considered exterior to the 'real' rules (e.g. clock in chess matches) must be engaged explicitly in digital games; these rules have to be programmed as well. Weather conditions or the general physics of a soccer game are usually taken as 'out-of-game' features in the real world. When we simulate a soccer game in a computer, however, the rules of soccer *and* the general physics (including random variables such as surface granularity, crowds, time of day, etc.) must be build into the rule algorithms and the computer's input-output control.

Rules specify the constitution of the playing 'deck' or, more broadly, the playing 'field'.[3] In games, behavioral patterns inside this field are limited, constrained, and highly codified (Huizinga 1994; Caillois 2001; Walther 2003). Rules are guidelines that direct, restrict, and channel behavior in a formalized, closed environment so that artificial and clear conditions inside the 'magic circle' of play are created (Salen & Zimmermann 2004). The outside of this circle, reality or non-play, is essentially irrelevant to gameplay. Confronted with unambiguous rules strategies (or tactics) might entail best practice solutions variable to the given rule constraints. Hereafter, interaction patterns map the various player interventions and can hence be viewed as a texture of moves and choices overlain on top of the game's possibility space. Furthermore, interaction patterns can refer to the social and competitive intermingling of players during the fulfillment of the game. In that respect, the patterns correspond with the outcome of absolute rules and social dynamics.

Rules have the following qualities:

- They limit and restrict player action. Thus, they tell what can be done and what cannot be done with the objects associated with the game.
- They are unambiguous, explicit, and finite (which is why they are easily incorporated in computer algorithms).
- All players of a game must share them.

- Rules are fixed, i.e. unchangeable (if they do change, we refer rather to local or 'house' rules).
- They are binding, i.e. non-negotiable.
- They can be repeated, which means that they are portable and work independent of technology platform or fictional representation.

The formal organization of games can be regarded as a parameter space. In this space the current state of the game counts as a point and ultimately a dimension in the parameter space. A played game has therefore *n* possible state dimensions. In *Tic-Tac-Toe*, for instance, the nine squares constitute the game's parameter space and thus the possibility domain for the arrangement of the board pieces. The rules of the game define the possible edges in the space connecting states. Rules define the *possible* game whereas a *particular* game is a path through the state space. The crucial factor is that there can be no variability or multiple paths through a game's possibility space without the compulsory parameters of the game. Hence, the parameter space constitutes the *transcendental* level of the game whereas the particular game path expresses the contingent *realization* of the space.[4]

This dialectic between parameter space and actual game path also sheds some light on why games are complex. Basically it is for the reason that there is an uneven relation between the unchanging set of rules and the actual, and changing realization of a particular game. This asymmetrical tie between rules and realization (or rules and strategies) can be termed game *emergence*. Most often it is impossible to pre-determine the actual moves and outcome of a game only by knowing the set of rules.[5] Also, most games are games of imperfect information (Nash 1997). At the outset, the rules of chess are simple, and yet the wealth of distinct chess playing tactics is quite enormous. A child can memorize chess rules, but to master all grand openings in the actual game is probably a lifetime achievement.

When it comes to computer games we must be careful not to confuse two distinct yet closely associated levels of rules. One level, which is the algorithmic source code of the game, consists of an unambiguous list of specifications for what can be done and what cannot be done, i.e. what counts as edges in the parameter space. On another level, rules designate the computer's ability to keep track of the players' interaction with the different states that the game system can be in. We can specify the former level the computer's *rule system*, and we will name the latter level the computer's *interaction system*. While the rule system contains the data structures that enable the initial set-up of the game as well as determine the game's constraints and possibilities, the interaction system evidently operates within a dynamic framework whose prime function is to control the executing of new outputs relative to the player's real-time inputs.

Another way of explaining the difference between the two levels is that the rule system is responsible for the *initial framing* of the game – it sets up the possibility space for the game and for the player's actions and choices – and, slightly different, that the interaction system links to the *actual gameplay* which, in turn, is the realization of, or a given path through, the possibility space.

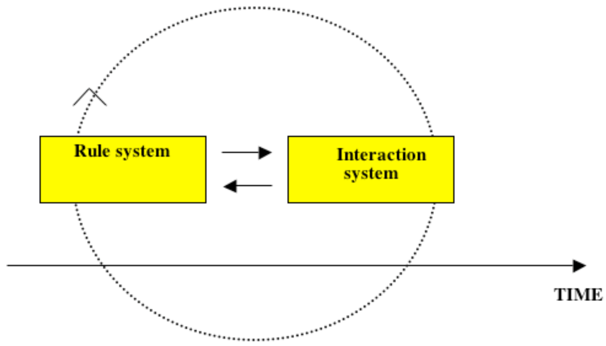

Illustration 2: Rule system and interaction system imply a combination of linear and circular movement, i.e. recursivity.

Further, we can model the relation between rule system and interaction system by considering also the machine domain and the player domain:

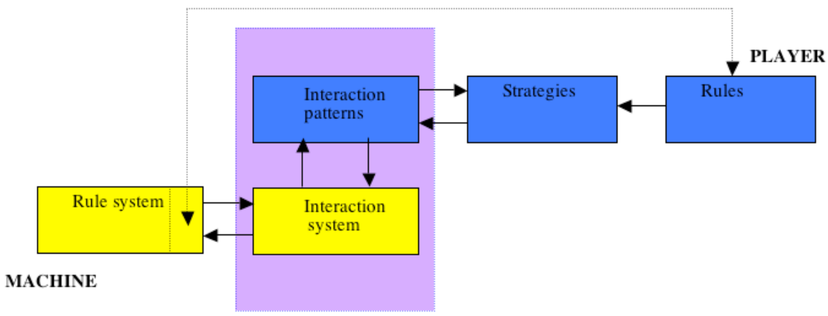

Illustration 3: Computer and player overlap in the interaction domain as a kind of middle ground.

Rules and recursivity

The movement from rules to interaction occurs in the medium of *time*. However, for this forward processing to be effective, the system needs to perform backward or *looped* executions as well. The events occurring in the game's possibility space constantly have to be measured against the initial rule system (see Ill. 2 and 3). In order for the computer to respond adequately to player inputs (which derive from the player's strategy) it has to 'check' the viability of input in accordance with the specified rule set. This rapid intersection of forward linearity and backward loop circularity defines the elementary *recursivity function* of a computer game. A recursive system, such as the computer, is thus a dynamic system consisting of both linear and circular operations. The computer handles progress because it also has a memory.

We may further refine the concept of recursivity by comparing it with what in computer science is known as the *state machine* (Selic, Gullekson, Ward 1994: 223ff.; Juul 2004: 57ff.). A state machine is a computing device designed with the operational states required to solve a specific problem. Automatic ticket dispensing machines are state machines, and so are computer games. There are several aspects of a state machine but we need only contemplate two for our present purposes:

- The *state transition function* maps states and inputs to states. This function defines, limits, and makes possible what happens in response to a given input.
- The *output function* maps states and inputs to outputs. This function defines the machine outputs at a given time. Y is thus a function that maps states and inputs to outputs *(S x I -> O)*.

When we look at the game as a state machine we find that the machine (i.e. the game) consists of an array of 'cells', each of which can be in one of a finite number of possible states. The cells are updated synchronously in discrete time steps, according to a local, identical interaction rule (which we identified above as the interaction system of a game). The state of a cell at the next time step is determined by the current states of a surrounding neighborhood of cells. The transitions are usually specified in the form of a rule table that defines the cell's next state for each possible neighborhood configuration.[6]

According to Juul (2004) the concept of rules corresponds to the notion of the state transition function that determines what will happen in response to a given action at a given time. The transition function is thus a specification of a set of deep rules, i.e. algorithms that determine the possible output relative to the current game state and the current player input at time *t*. Next, the output function sends a specific view of the game state to the player; a view or a piece of information that is mediated through the computer's interface (e.g. a specific screen image, a textual message, etc.).

However, what we are dealing with here clearly involves rules that attest the computer's capacity for *response* or *adaptiveness* in a variety of settings and a number of game states. Thus, the state transition function and the output function relate strongly to the computer *interaction system* whose primary function, as stated above, is to control the executing of new outputs relative to the player's real-time inputs. When viewing the computer as a state machine we can then further identify the *rule system* (see above) as the possible *input events*. These are the inputs that the machine accepts, and this level of the machine determines the constraining elements of the game (the edges in the possibility space) specified by the rules.

In short:

- Input events -> *rule system*
- State transition function and output function -> *interaction system*

The recursivity of digital games therefore implies a linear as well as a circular relation between input events, state transition function, and output function. Phrased differently: recursivity results from the complex intersection of the game's parameter space (input events and possibility space) and the game's interaction system (output function).

Traditionally, the notion of recursivity is used within group theory where it designates a group that is defined using the own group or function that it calls to the own function. Also, the term is deployed in certain programming languages (such as C++) where recursivity is the property that functions have to be called by themselves. Here, however, we will stick to the broader and more general definition of recursivity indicative of systems that entail a dynamic oscillation between linearity and circularity.

My point is that this general classification of recursivity is indeed a formal or structural definition of 'self-referentiality'. We could say that self-reference in e.g. literature operates as codified or semantic relations between possible input events and output function. However, for the input events to be functionally effective they have to be stored and made actively operational in the reader's ('player's') mind so that they may act as base for the current output function. This means, in essence, that the mind corresponds with the computer's memory as well as resembles the state transition function of a computer.

The analogy is this: I stumble across a character in a novel and thinks that this character is somehow connected with a character or a situation in another novel; or I may begin to wonder whether the entire design of a given novel might not, in an implicit fashion, be an allegory of a textual information to be found elsewhere. More advanced, I might postulate that the novel I am reading (as a series of mental outputs that determine my 'path' through the narrative) on a more profound, hidden level invokes the transcendental conditions of its own 'being-narrative'.

Whether I am concerned with identifying passages linking fictional characters, or whether I am trying to demonstrate a novel's own poetological modality of self-reference; what happens is that I link possible input events (what is referred to) with the current output function (i.e. what is considered to be signs of self-reference). However, in the case of reading a novel and scrutinizing its complex web of reference this procedure needs to be implemented in a purely hermeneutic framework; self-reference in non-digital media does not possess an automatic state transition function that maps states and inputs to states. In non-digital media what happens in response to a given input (the state transition function) *is not part of neither rule nor interaction system*.

Rules formulated in and controlled by computers always hinge on algorithms that only react to very selected aspects of the world, e.g. the state of the system or the well-defined inputs (Juul 2004: 61). A game thus has a predefined and finite number of input events whereas the input events that act as referential 'markers' in the self-referential circularity of a novel are clearly infinite in number. The computer controls the finiteness of algorithms and output functions using a *necessary decontextualisation*, which means that only a selected number or no parts at all of a given context is relevant to the game system. On the contrary, the human interpreter controls the relation between input events and output function by deploying a *potential contextualization* that allows for a principally infinite number of any parts of a given context that may be relevant for an understanding of the system.[7]

This allows for the following definitions:

- *Computerized 'game' recursivity* implies an automatic, cybernetic process in which only a finite number of input events are accepted as base for possible output functions. The dynamic system therefore presupposes a trivial relation between the initial possibility space and the information (or output) shown to the player in a given game state.
- *Hermeneutic 'fiction' recursivity* implies a non-trivial process in which an infinite number of input events (that together form the possibility space of referentiality) can be potentially linked to a likewise infinite number of output functions (that are the self-referential signs).

It is vital to be aware that this double definition could have been made without inducing any content or fiction oriented phenomena. Any mention of 'novel', 'text', etc. was only provided for their exemplifying value. The difference lies solely in the formal nature of computer games vis-à-vis non-digital media such as codex literature and cinema. We can illustrate the concept of recursivity thus:

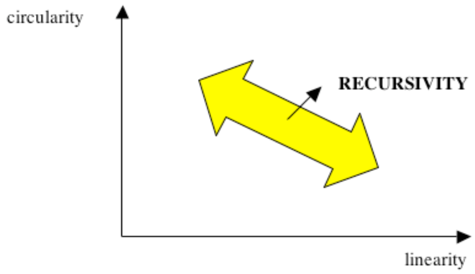

Illustration 4: The recursive system depends on an oscillation between linearity and circularity.

Game epistemology: gameplay and recursivity

In the previous section we saw how rules and interaction system together define the ‘game-ness’ of games. Now we will enquire more deeply into the logic of game*play*, the playability or ludic structure of gaming.

Using the systems theory of Niklas Luhmann as well as the form theory of George Spencer-Brown I tried, in Walther 2003, to categorize and reflect on the difference between ‘playing’ and ‘gaming’. The trick is to view gaming as something that takes place on a higher level, structurally as well as temporally. When it comes to play, the installation of the form of the play-world-non-play-world distinction must, performatively, feed back on itself during play: continually rearticulating that formal distinction within the play-world, so as to sustain the internal ordering of the play-world. However, in the game-mode, this rearticulation is already presupposed as a temporal and spatial incarceration that protects the rule-binding structure of a particular game from running off target. In other words: games *should* not be play; but that does not imply that they do not *require* play.

This means, in effect, that in the play-mode the deep fascination lies in the oscillation between play and non-play, whereas game-mode presses forward one's tactical capabilities to sustain the balance between a structured and an un-structured space. In play-mode one does not want to fall back into reality (although there is always the risk of doing so). In game-mode it is usually a matter of climbing upwards to the next level and not lose sight of structure. Play is about presence while games are about progression.

In play the deep fascination lies therefore in the oscillation between play and non-play, which is the ‘other’ of play usually considered to be ‘reality’. In the playing of games we are more fixated on progressing within the prior structure that is the game (Kirkpatrick 2004: 74). Gaming presupposes the tension, or the initial transgression, in which we constantly resist falling out of the fantasy context of play, and gaming further focus on a second, higher transgression, in which success and failure is measured against our achievement of defined objectives. Thus, in playing a computer game we work within a second simulacrum, an 'as if structure' overlain on top of the first initial transgression that makes play possible in the first place.

Two things are particularly important with respect to our investigation of self-referentiality or recursivity in computer games. First, we can note that the act of gaming or gameplaying involves the fabrication of willed illusions that support the progress from initially stepping into the magic confines of play and, subsequently, trusting and acting in accordance with the fixed rule set and structured topology of games. Second, as Graeme Kirkpatrick writes in his interpretation of my research in these matters, it also

> […] involves a certain self-understanding; players know that they are responsible for maintaining the illusion that is the game world and the sense of play that supports it. This knowledge ultimately threatens the game and play itself, giving it a kind of ontological insecurity. This is why play is often repetitive, since repetition reinforces the reality of the game world. However, this same repetitiveness results in a kind of disenchantment for the player […] and an inability on her part to continue 'foregrounding' the game play experience (Kirkpatrick 2004: 74f.).

In systems theoretical terms this self-awareness of ontological insecurity translates into the player's ultimate understanding and therefore constant handling of the *other reference* within the game itself that is, simultaneously, part of the game's *self-reference*. It is a fundamental sign of the game itself – and the players have to be aware of, even stay alert to this fact – that the threat of a 'non-game' domain or a 'non-gaming' situation is forever intrinsically tied to the game's own construction. Thus, a certain level of self-referentiality or, at the very least, a minimal awareness of the logical organization of play and non-play is required. Gameplay necessitates a reference to the way in which a game feeds from its own negative preconditions; this reference is obligatory for any actualization of a game. In psychological terms, when a game becomes uninteresting it is likely because the player fails to sense a presence from the inside of presence's deterritorialisation (Walther 2003). The player 'falls out' of the constraints and the negatively defined territory that is the game. In the words of systems theory, to play means to engage in a dynamic oscillation between levels of transgression without getting caught in the ontological uncertainty that is part of the game's set-up. To play also means to master the critical coincidence of reference and self-reference – i.e. the ability to toggle between what the game is *about* and what it takes for the game to *come about.* A certain – if not always explicitly articulated – level of self-referentiality is hence an essential element of gameplay.

The success of transforming games (e.g. board games) into *computer* games might stem from the fact that a digital computer is a discrete state machine. It thus bears, in its very design, a strong resemblance to formalized game systems, most notably rules for discrete sequential operations. In contrast, play seems to focus on investigations of semantics, since the task is, not only to measure its space, but furthermore to elaborate upon its modes of interpretation and means for re-interpretation. Not only do we explore a world while playing. Its potential meaning and the stories we can invent in that respect also drive us. Play spaces tend to expand, either in structural complexity or in physical extent. This expansion is further reflected in the praxis of play, for instance when players argue over the exact thresholds of a play domain (cf. Tosca 2000). Again, this must be understood in a double sense, meaning both the physical closure and the mental activities attached to it.

Why is this simultaneous division between and intermingling of play and games important for the study of computer games? Because it touches upon the concept of *gameplay*.

One can get immersed in the playing-mood that is needed to get into the game in the first place (the first distinction that enables one to identify with an effective killer), but one can also be caught up in a certain area of the game where one begins to question its criteria for structure (the second distinction that focuses on transitions). Too much self-reference spoils the gameplay! The plot is exactly to balance playing and gaming *while* gaming. One must hold on to the initial distinction (otherwise one is swallowed by the other of play), and one needs constantly to accept the organization, the rule pattern, of the game. When one disregards this complementary balance a flow is interrupted. Then one begins to speculate: why am I playing; and what exactly is the objective of the game?

A gameplay works precisely to assure this flow by serving as a potential matrix for the temporal realization of particular game sequences. One such sequence may lead one to wonder how one got into the game in the first place (then one observes the first transgression, and one is in play-mode), or the actual sequence might force one to reflect upon the criteria for the design of the space-time settings (in which case one observes the second transgression, and one is in game-mode).

The recursivity of rules and game worlds – a kind of conclusion

I began this article by pointing out that self-referentiality in computer games splits into three distinct forms: 1) Games can be self-referential as part of the way in which they handle import and export of content or fiction related elements; 2) games refer to a larger and immensely complex horizon of cultural *bricolage*, a kind of cut-copy-and-consume culture; 3) and, finally, and most importantly, the intrinsic fabric of computer games points to an all-necessary level of self-reference or recursivity without which games, both ontologically and epistemologically, would simply cease to be ‘games’.

Next, we found that formal recursivity in computer games can be linked to two different modes:

- On the level of *game ontology* there is a recursive dynamic between rule system and interaction system, i.e. between the possibility space or input events and the actual path through the game's states.
- On the level of *game epistemology* we documented a recursive dynamic between the transitional differentiations of play-mode and game-mode that together make up gameplay. The fact that there is a dynamic (temporal as well as logical) relation between 'playing' and 'gaming' also indicates a certain level of recursivity mandatory of gameplay.

Also, we must be aware that there is a vital discrepancy in the concept of 'self-referentiality' when we regard it as an intrinsic constituent in the computer's workings as opposed to the idea of a hermeneutical relocation of 'input' references and 'output' signs of self-reference. In the former case, self-referentiality is something that is *performed* and trivially *executed*; while, in the latter case, self-referentiality is something that needs to be *perceived* and actively *interpreted*.

Actually, things are very simple. All digital games are naturally *cybernetic, self-referential systems* (Kücklich 2003), whereas all non-digital media, including fiction and cinema, is basically *semantic, referential systems* that *can* be perceived as self-referential entities. This does not, however, exclude the subtle fact that digital games, on top of being formally self-referential, *may* be self-referential also on a content related or cultural level.

But how about the *gameworld*? What is the relation between game rules and fictional representation? As a kind of conclusion, let me briefly show how the formal requirements of a game may be inscribed in the game's fiction, and, perhaps, vice versa.

Many games seem to disrupt the unfolding of narratives within game worlds in order to assist the player in how to control the keyboard, how to set up the buttons on the joystick, etc. One example (Juul 2004: 158f.) among many is the GameCube game *Pikmin* in which our avatar is a scientist stranded on an unknown planet. In the course of gameplay, the scientist takes notes in a diary that is displayed on the screen, including notes about the handling of the controller. According to Juul there is nothing 'artistic' about this deliberate mix of fictional representation and game control commands. In fact, this confusion even strengthen the fiction: since the player 'is' the avatar, notes about the controller is "exactly the kind of thing we would write down if we were to take notes about our playing of the game" (Juul 2004: 159).

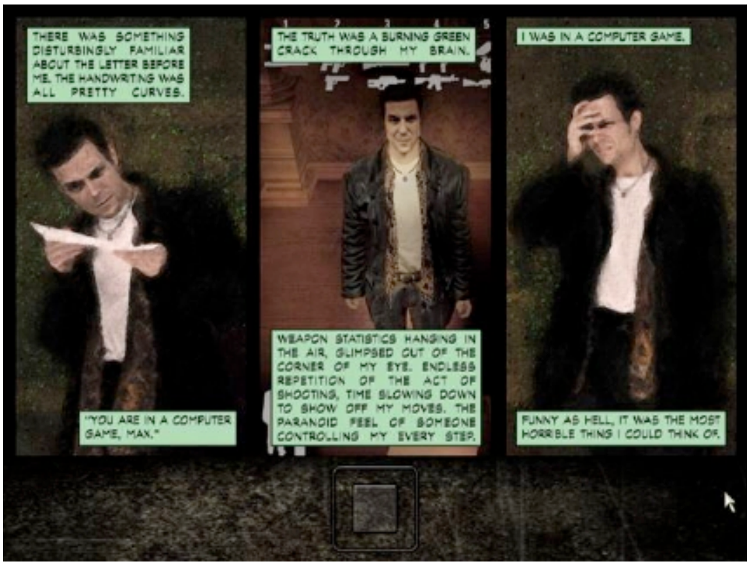

Illustration 5: Max Payne realizes he is – horrifyingly – a character in a computer game.

Another example, however, tells us that the reference system of games is not always that straightforward. In the adventure based first-person-shooter *Max Payne* we are, as noted by Søren Pold (Pold 2005), caught in a stratified maze controlled by drug lords and corrupt police on the level of the plot and the cybernetic game engine on the structural level. More than allocating the in-game story as a motivation for gameplay, which is typical of the genre, *Max Payne* designates the narrative as a cliché; the Hollywood signs "point towards narrative structure in general rather than support the particular narrative" (Pold, ibid.). Pold continues:

> […] the game could be interpreted as a self-conscious intervention in the ongoing debate about the roles of narrative in computer games. Narrative becomes an effect that the game self-consciously alludes to and puts on but does not fulfil in the deep Aristotelian way imagined by the proponents of interactive narrative. This is narrative surface or skin that does not attempt to become hegemonic, covering all aspects of the game, but like postmodern novels and cinema alludes to narrative, quotes it, without fully enacting it (Pold 2005).

In a graphic novel sequence in the drugged opening of the third act, Max Payne finally realizes and reveals to the player that he is nothing but a pixilated avatar in a computer game. Suddenly, Max Payne, as a pre-condition for the game's plot, questions the initial and vital transgression of play. Consequently, through the meta-fictional confession we are thrown into play-mode. Why play if the character that is supposed to glue together playful praxis and structured game space is genuinely untrustworthy?

Payne's existence serves only the endless repetition of the game, which is the at once dull and sophisticated blend of 'realism to the max' and 'max pain', advertised through the graphical user interface with its weaponry, red bar, and bullet time on-off-button. Pold concludes by categorizing *Max Payne* as "illusionistic media realism" (Pold 2005), a realism that simultaneously engages in illusion and can be viewed as a self-reflexive exploration of its own representational techniques and media. In light of the findings of this article, we may further hypothesize that *Max Payne* knows and plays with its own recursive dynamic and places it amidst the fictional elements as a self-conscious cue to its own rule structure and level of progression. Games like *Max Payne* therefore ironically mocks at, yet at the same time celebrate, a self-awareness of how the necessary recursivity of *all* games (not just the intentionally artistic ones) gets immersed into the 'fiction' while clearly belonging to the trivial, non-semantic level of 'rules'.

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[1] This emphasis on the formal side of games and game theory is definitely not constructed so as to denounce any kind of study that enquires into the fictional or intermedial self-referentiality in computer games. Readings of self-referentiality of the latter kind, on the contrary, will provide us with much knowledge of the culture of narrative 'transfer' in the contemporary media system. However, it is my genuine belief that the initial distinction between structural and fictional self-reference in games – as well as in other types of media – clarifies discussions that otherwise tend to obscure the levels of analysis: computer games are by necessity self-referential (or recursive), dynamic systems; yet not all of them need to be self-referential in a fictional sense. What does the game *Tetris* refer to? Nothing, really – unless, that is, one would claim that the image of falling polygons in a vectorized field is an indicator of a cultural dynamic ('text') of some sort.

[2] I say advisedly 'cultural' and not 'sub cultural' since games nowadays are *the* norm of mediated communication and not just a more or less esoteric sub-branch that connects to the entire media ecology.

[3] The notion of deck and field also alludes to the common sense comprehension of games – board games and sports count as archetypes.

[4] Here, we may note that the game in itself is set in a *spatial* realm. The nature of the spatial structure pre-determines the organization of edges in the topology. Contrary to this, the particular playing of a game is functionally operative solely in the domain of *time*. A game *exists*; but a game also *evolves*.

[5] This does not mean that the player is incapable of optimizing his or her strategy by knowing and, essentially, anticipating the computer's rule-based *responsiveness*. In the game *Need for Speed* awareness of features such as 'catch up effect' and 'spawn' mechanisms effectively aid the player in obtaining the game's primary objective – to win.

[6] Thus, we could formally define 'a game' as the sum of all states of cells at time *t*, which, in turn, is a function of the state of a finite number of cells called the *neighborhood* at time *t-1*.

[7] I guess this is another way of claiming that the mind works in mysterious ways and that a computer operates in entirely pre-determined ways.