

Simulation: Games, Art and Science¹

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Introduction

In this paper I want to discuss some ontological and epistemological issues connected to computational simulation in computer games and scientific computer simulations. Both create so called virtual worlds and both deal with entities of a strange ontological status. The talk of ‘virtual reality’ exemplifies their in-between ontological status: In some way the simulated content claims to be ‘real’, but at the same time its reality is specified as *only virtual*, thus being in at least one respect deficient compared to ‘real reality’.

Using an everyday, and in some ways naive, understanding of the concept of ‘realism’, one could argue that state-of-the-art computer games often give us a far more realistic representation of non-virtual reality or ‘the world’ than scientific computer simulations do: *Seemingly* the virtual Liberty City in the computer game *Grand Theft Auto IV* is much more realistic in its representation of the non-virtual New York City than the simple colored patterns of a scientific computer simulation are in their function of representing the development of the world’s climate. However, probably no one would deny that while we first and foremost use computational simulation models to learn something about their target systems, the primary function of games is a different one. This does not necessarily mean that there is nothing we can learn about the world from playing games, i.e. that we have to deny the epistemic value of computer games entirely.

I want to argue that any line of thought which tries to tackle the problem of a clear and philosophically founded distinction between computer games and scientific computer simulations by working with a mimesis conception of ‘realism’ is misguided. By setting straight this misconception, we can achieve some philosophical insight on questions concerning reference, representation and different modes of cognitive relation to the world. Since most approaches towards conceptual questions raised by computer games are based on a comparison between narratology and ludology, I will reflect on the relation between artistic texts, computer games and scientific computer simulations by differentiating between certain types of reference connected to certain types of symbol systems. Mainly, I will draw from the theory of secondary modeling systems put forth by Jurij Lotman in his seminal *The Structure of the Artistic Text* and Nelson Goodman’s theory of symbol systems in *Languages of Art*.

I will advance in three steps, asking the question of reference and realism for artistic texts (1), for scientific models (2) and for games (3).

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Artistic Texts

Lotman defines art in general and literature in particular as a “secondary modeling system” which is constructed on top of the “primary modeling system” of natural languages. This means that the language of literature is only comprehensible and thus possible if it draws from natural language, but it also means that inside the system of literature words are assigned new meanings. According to this theory, one should drop the naive view that the referents of the secondary modeling system are identical to the referents of the primary modeling system: E.g. in Thomas Mann’s novel *Der Tod in Venedig* ‘Venice’ does not only denote a city but also transgression, death, liberty and homosexuality, whereas as part of the primary modeling system ‘Venice’ solely denotes Venice.

A secondary modeling system constructs its own system of referents that is not a copy of the system of referents of natural languages. To believe that ‘Napoleon’ in a piece of fiction refers to Napoleon is to confuse the secondary with the primary modeling system, i.e. to mistreat the fictional world of a piece of fiction *as non-fictional*. This position entails the refutation of a naive view on ‘realism’ in literature that is based on what can be called the ‘copy theory’ or ‘mimesis theory’ of realism. According to such a theory, realism is assigned to literature (and art in general) in degrees, based on the criterion of being *similar* to the ‘real thing’, i.e. being a more or less faithful copy of outer fictional reality.

Nelson Goodman has put forth a string of arguments against such theories of realism in art: The copy theory is incapable to specify *what* should be copied: “for the object before me is a man, a swarm of atoms, a complex of cells, a fiddler, a friend, a fool, and much more” (Goodman 1996: 6). There is no ‘innocent eye’, stripped from perspectivity and cognitive mediation. Any theory of art that postulates pure reception without cognitive mediation commits itself to the aesthetic equivalent of the epistemic ‘myth of the given’. (Cf. Goodman 1996: 2) To copy one aspect of an object really means to construct such an object. The cognitive activity involved in receiving art becomes evident when the mediating function of cultural norms of reception is brought to light: The inhabitants of the Bismarck-Archipel in the South Seas had tremendous problems ‘reading’ the photographs they were shown by German anthropologist Richard Thurnwald, e.g. they weren’t able to distinguish consistently between water and the sky. (Cf. Rieger 2001: 219ff.) Our paradigm of realistic representation is in no way universal. So what are we to do if similitude is not a good criterion for realism? Goodman gives us the following answer: “Realism is relative, determined by the system of representation standard for a given culture or person at a given time”(Goodman 1996: 37); or as Roman Jakobson puts it in his seminal essay “Über den Realismus in der Kunst”: “There is no sense in talking about the ‘natural’ probability of a verbal expression, a literary description. It seems impossible to talk about the probability of poetic tropes, to say that a metaphor or a metonymy is objectively more real than another.” (Jakobson 1994: 377) A work of art thus creates a model of the world of which can be said that it does *not exist* outside of the language of the secondary modeling system.

Nevertheless, the question remains if this excludes any possibility of reference to ‘reality’ by *transposing* the model of the secondary system to outer fictional reality. Interpreting an artistic text is such a transposition, but giving an interpretation is nothing more than constructing a fixed meaning by creating *monosemy*. However, what makes a text an artistic text, its essence so to speak, is its polysemy. This polysemy is the result of the text being a secondary modeling system: “every detail as well as the entire text belongs to different relational systems and thus receives more than one meaning. This property becomes evident

in metaphor, but it is of much more general character. (Lotman 1993: 105) Lotman draws our attention to the fact that in case of a given interpretation there always remains an “untranslatable rest” which the interpretation is unable to capture. (Lotman 1993: 107) The meaning of an artistic text can therefore be identified with the set of possible interpretations. (Cf. Lotman 1993: 108) Thus, achieving monosemy for artistic texts comes down to destroying the artistic text as such and replacing it by a non-artistic one.

The fact that the aesthetic quality of a text as well as its potential for interpretation is rooted in its polysemic nature allows for the thesis that art has an epistemic function. What we can know through art is not based on it being an adequate copy or representation of how the world is in itself but in the way it gives us the possibility to re-construct, re-assemble and re-cognize our everyday perception of the world. The relation between non-artistic reality and its artistic modeling is dialectical: The signs of the primary modeling system of natural language are the basic elements of the system of the artistic text. However, as parts of the secondary modeling system these elements gain new meanings that finally are carried back to the non-artistic system, restructuring our cognitive access to the world. The relation between art and world is not one of mimesis or faithful representation but one of *modification*.

Science

Some authors have argued for the similarity between art and science. Roman Frigg has recently advanced the view that a better understanding of scientific models can be achieved by drawing from their similarities to (literary) fiction, and Nelson Goodman has pointed out that the view that scientific practice is based exclusively on denotative and literal linguistic propositions has a blind spot. Scientific practice is full of metaphors like “charm”, “strangeness” or “black holes” (Cf. Goodman 1990: 132) that shape the activities of measurement and theoretical design.

Scientific modeling is based on idealizations, distortions, corrections, deliberate negligence of and concentration on certain properties of phenomena. Due to this “highly stylized” (Frigg 2007: 2) nature of scientific models it follows that “[t]aken literally, descriptions that ground structural claims (almost always) fail to be descriptions of the intended target system. Instead, they describe a hypothetical system distinct from the target system.” (Frigg 2007: 4) I do not want to further evaluate the arguments on a line with Frigg or Goodman, instead I merely want to point out one major difference between scientific models and secondary modeling systems: Never mind how the relation of the modeling system to the target system is conceived (we can think of naturalistic, realistic, constructivist or pragmatist theories) there is always the presumed epistemic relation to the target system. This epistemic relation is based on monosemy. Every scientific model is in need of interpretation, but in a different sense than this is true for artistic models: while it is *constitutive* for the scientific model to be monosemic, the possibility of providing a monosemic interpretation of an artistic text presupposes its polysemic character. While a scientific model is not a scientific model without being in some sense *about* its target-system, artistic models aren’t *about* anything at all, at least if we understand the ‘about’ in an epistemic sense. So never mind how ‘simple’ the visual presentation of a scientific simulation, e.g. in climate simulations, may seem to us, its ‘realism’ as a scientific model does not depend on that but on the applicability of its underlying mathematical model to certain real life phenomena (its target system). Regardless if we take a realist or an anti-realist stance on questions of scientific theories, models and the involved theoretical entities, there is always a presupposed epistemic relation of referentiality

invested into scientific models that is logically independent of the visual presentation. Without any doubt, many simulations rely on a realistic (in the relativist sense introduced above) visual presentation in order to be epistemically fruitful: policy makers as well as scientist might draw different conclusion from different visual presentations of the same underlying solutions to mathematical equations. The question of realism is however one that concerns the heuristic success of such (simulation) models *not* the faithful depiction of ‘nature itself’.

Games

We might be tempted to develop a view on computer games that is based on our conception of art. Scholars of film and literature have approached the field of computer games with the analytical instruments of their respective domains, often treating computer games as interactive narratives. Lotman on the other hand clearly distinguishes gaming models from artistic models. For him, games have a twofold ontological and epistemic status: On the one hand, games consist of real rules in the sense that if someone does not take them seriously, he will stop or won’t even begin to play the game. On the other hand, games are a kind of make-believe. They are fictional in the sense that the real rules create a gaming situation that has no correspondence in reality. If the fictional aspect of games is forgotten by the player, then the games ceases to be a game and becomes serious (e.g. kids starting a real fight in the course of a war game). Obviously the twofold ontological status of games is not to be separated from its twofold epistemic status: For the rules to *be* real and the gameworld to *be* fictional, it is constitutive that the player takes a corresponding *epistemic attitude* towards them.

In the following I want to show that Lotman’s theory is faulty, but that it nevertheless provides a solid basis for modifications that can lead to a satisfying account of games. Jesper Juul is right in saying that the “issue of fiction in games is tricky since much depends on the games we are looking at.” (Juul 2003:4) We only have to think of games such as *Tetris* or chess (played on a computer or not) to realize fictionality or make-believe is only accidental and “not universal to games” (Juul 2003: 4). The main problem lies within Lotman’s paradigmatic example of games: children’s role playing games. There are many practices we call games even though they do not meet the criterion of make-believe or fictionality. Where, one might ask, is the element of make-believe in a game of soccer, chess, *Tetris* or in games of sheer luck? Gambling for example seems to be entirely stripped of any make-believe content, real *effects* (winning or losing money) are even constitutive for it being the game it is. I think these objections have to be taken seriously. However, I believe they should *not* make us dismiss Lotman’s theory as such, but they should help us modify his view on games. We should not be distracted by the fact that some games seem to have real life altering outcome while others don’t, and some games involve some kind of make-believe (e.g. children’s role playing) while other don’t (e.g. soccer), and some games are about winning or losing and some aren’t.²

Espen Aarseth has put forth an analysis of the constitutive elements of games: “Any game consists of three aspects: (1) rules, (2) a material/semiotic system (a gameworld), and (3)

² Pace Juul (2003: 9) I agree with Frasca (1999) that the difference between *paidia* and *ludus* is not the difference between games without and games with fixed rules. Every *paidia*-activity is rule based, however simple and few they may be (e.g. don’t behave like a postman if you are playing a ship’s captain). The distinction has to be rather based on games that can be won or lost (*ludus*) and games that are open ended (*paidia*). Juul’s claim that role playing games have no set of fixed rules just seems plain wrong.(Cf. Juul 2003: 9)

gameplay (the events resulting from application of the rules to the gameworld).” (Aarseth 2004: 2) Even though I believe these three aspects are indeed crucial, I want to propose to add a fourth aspect: the player. There are no games without agents *doing* something. The rules only determine a set of *possible* moves (in German: der Spielraum) within a given game; the player’s actions then determine the *actual* moves. This modal difference between the actualization of the rules as a result of the player’s actions and the possibility of moves inherent in the rules can only be experienced by the player and lies at the core of games: “The game [das Spiel] reproduces the combination of law-like and contingent processes in a specific manner. Due to the accented repetitional character (the law-likeness) of the situations (the game rules), every deviance becomes particularly meaningful.” (Lotman 1993: 102) Surely, all forms of art involve some kind of activity, i.e. the aesthetic reception of which we shouldn’t think as receiving a ready-made given (this was Goodman’s main argument against naive realism). The activity in games goes further than such pre-conscious acts of spontaneity: Moves in a game are actions that can be described as putting to use certain means to realize certain ends, whereas the material basis of the means and the ends is medially interchangeable (cf. chess and mind-chess). It is important to note that such a view does not entail the counterintuitive view that a game ceases to be a game when no one’s playing it. A game must be a system of rules that holds the *possibility* of its actualization by a player which is completely different than saying that something must be *actually* played with to be a game. If games are not games without the possible moves of a player, then it stands to reason to focus on what determines those possible moves: the rules. John Searle offers a helpful distinction between *regulative* and *constitutive* rules. (Searle 1995: 27ff.) While *regulative rules* apply to an already existing practice and are therefore logically subsequent, constitutive rules are logically prior to actions in the sense that the actions themselves presuppose those rules. The standard example for a regulative rule is the rule stating on which side of the road one has to drive a car. Driving a car is something we can do without that rule. Therefore, the rule of driving on one side rather than the other is a rule regulating a practice that is logically independent of it. The paradigmatic case for constitutive rules are game rules. In the case of a game of baseball:

Striking out, stealing a base, balking, etc., are all actions which can only happen in game. No matter what a person did, what he did would not be described as stealing a base or striking out or drawing a walk unless he could also be described as playing baseball, and for him to be doing this presupposes the rule-like practice which constitutes the game. The practice is logically prior to particular cases: unless there is the practice the terms referring to actions specified by it lack a sense. (Rawls 1999: 37)

We are now in the position to reconsider the argument against games involving acts of make-believe. Someone engaging in a game of soccer does not *pretend* to be a soccer player but he *is* one. ‘Passing the ball’ or ‘standing offside’ are actions that do not exist outside the practice of the game. The same goes for actions in *Tetris* such as ‘turning an L-shaped block 90° to the left’. So what is the element of fictionality or make-believe in a game of soccer or *Tetris*? The aspect of fictionality of games does not consist in the faithful representation of real life behavior or situations but in the *simulation of new types of behavior that do not exist outside the practice of the respective game*.

Gonzalo Frasca has argued that (computer) games are best not described in terms of representation but in terms of simulation. (Frasca 2003: 3) Following Stephan Hartmann we can define simulations as following:

[S]imulations are intimately connected to dynamical models, i.e., ones that include assumptions about the time evolution of a system. [More specifically, a simulation amounts to solving the equations of a dynamical model, which accurately captures the time evolution of the target system;] if the simulation is run on a computer it is a computer simulation. (Frigg/Reiss 2007: 5)

This definition is apparently - due to its talk of target systems and solving equations - one that is established for the field of scientific simulations. If we leave out the second sentence I put into brackets, we have a useful definition of games as simulations. We can transform the last sentence and say: If the simulation is run on a computer, the game (as a dynamic model) is a computer game.

What we said about the non-mimetic character of art is as well the case for games: the relation between games and the world is not one of mimesis or faithful imitation but one of *modification*, *restructuring* and *reorganization*. While art restructures our cognitive approach to the world, games restructure the way we *act*. Pieces of art create new worlds in providing new symbolic orders and combinations while games re-structure our actions.

However, games not only create new actions, but they also often *reassemble* new actions from more basic bodily movements: Manipulating blocks in *Tetris* is made up of the actions ‘pressing button or key x’ which itself is made up of performing certain acts of hand-eye coordination. The same goes for performing a free kick in a soccer simulation or stealing a car in *GTA IV*. The bodily movements that *constitute* the in-game actions can themselves be described as actions: e.g. ‘putting one foot in front of the other’, ‘turning the ankle’, ‘running’, ‘kicking’ are valid descriptions for everyday actions, but they are also the valid sub-descriptions for the in-game action of ‘scoring a goal’ in soccer.

Games sometimes even reassemble actions of other games: Computer games seem to offer many good examples for such metalevel simulations of game-immanent actions, such as handling the game-controller in order to score a goal in a computer game of soccer.³ But what of make-believe children’s games that involve descriptions like ‘pretending to be dentist’ or ‘pulling a tooth’? ‘Pulling a tooth’ is undoubtedly an action description that is not constituted by the rules of the game. I think this can be solved easily by pointing out that even though the same words are used in the descriptions of actions of a dentist and a child pretending to be a dentist, the descriptions do not describe the same action. The child is not actually pulling someone’s teeth; it is maybe just moving its hands around the facial area of its doll. The description ‘pulling a tooth’ will be correct for the gaming situation without the player actually pulling a tooth and it will only be a valid description of the gaming situation if the player is *not actually* pulling the tooth. If the player did pull the tooth, it would not be a game immanent action description. Therefore games are secondary modeling systems of actions and their corresponding abilities or skills. Games are based on real life actions and their constitutive rules, but those actions are remodeled in the game with the result of new, game immanent actions.

Computer games pose a genuine challenge to this thesis that is best explained by an example: In arcade racing simulations the player steers a virtual vehicle through a virtual environment by handling a real wheel as well as real acceleration and break pedals. One could argue that the actions of such a game are neither part of a new practice (one can steer a car in real life), nor are they modifications of an already existing practice (driving a car or flying a plane in

³ Cf. Table football as an example for a non-computational metalevel simulation.

real life and in computer simulation may involve the same bodily movements). But the actions ‘driving a car’ and ‘virtually driving a car’ are not the same actions, just as *dreaming* (or *imagining*) *that p* and plain *that p* is not the same state of affairs.

If games are indeed *secondary modeling systems of actions*, then the question of realism has to be answered in a way that recognizes the specific nature of secondary modeling systems. Games incorporate a multitude of different symbolic elements, ranging from pictorial over verbal to acoustic etiquettes.⁴ The question *how* these different types of etiquettes or symbolic layers shape the game *as a game*, e.g. the interrelations between the physics engine and its visual realization, has to be passed on to a genuine *game studies* and its analytic equipment. For our purposes it is enough to see that future ludologic accounts should not fall into the trap of naive copy theory based realism in any of its aspects of analysis.⁵ What happens to games when used as tools of scientific research is another highly relevant and difficult question, but one that has to be addressed separately.

When are games?

One could argue that even if what was said so far is correct, the following problem remains: There are many examples of newly constituted or reassembled actions in non-gaming contexts. Something like ‘scanning a brain’ or ‘surfing the web’ was not a possible action description a hundred years ago. Nevertheless, it is obvious that these actions, logically subsequent to their presuppositional practices, are not elements of games. It seems that we have to presuppose the understanding of games to say something about them as secondary modeling systems. The prospects of a genuine ludology seem dim if we aren’t able to define its domain of discourse.

Again, a look at art is helpful: Under regular circumstances a stone has no symbolic function, it neither represents nor denotes nor exemplifies anything. But if we are confronted with the same stone in a museum, thus under *artistic circumstances*, it does indeed take up symbolic relations. Art is not ready-made, its does not lie around as such. Pretty much everything can be received as art and therefore pretty much everything can *be* art. The question, as Goodman puts it, is not what objects are art but *when* objects are art. (Goodman 1990: 86ff.) In the same manner it is possible to make a game out of (almost) everything - just as it is possible to turn every game into serious business. A game of chance that includes the possibility of winning or losing real money should still be regarded as a game. It ceases to be one when gambling turns pathological, i.e. not when it entails real life consequences but when the real life consequences become so dominant that we do not engage in the gaming activity for its own sake but use it as a simple means. Even in non-pathological cases we tend to reprove attitudes towards playing that foil the fun of the game, e.g. when someone plays just for the sake of

⁴ I do not agree with Juul (2003) that the visual elements of a game are negligible for the gaming experience. From a phenomenological point of view it is obvious that the graphical depiction of bullet holes in *Duke Nukem 3D* added a new level of fun in comparison to early shooters like *Doom*. Such a view may be perceived as low-brow gaming attitude, but the evaluation of ‘good’ and ‘bad’ taste concerning computer games is something scientist should leave to feature writers.

⁵ It is unique to games that they incorporate many different types of symbols or etiquettes (pictorial, verbal, etc.). Therefore, a genuine game studies or ludology has to rely on the entire field of aesthetics (e.g. narratological analyses). However, what should separate game studies from other sciences of the arts is that it should try to analyze elements of narrative or of other artistic nature exclusively *as shaping* the game as a secondary modeling system of actions and abilities.

winning or solely for reasons of monetary gain.⁶ This doesn't rule out the wish to win a game: If the fun of a game exists in coming to know the modal difference between the possibility of moves determined by the rules and the successful actualization of these rules, then it follows that if winning is part of the game, a successful actualization of the rules *includes* winning without being reduced to it.

In the end, I believe that Kant's description of "Spiel" as a "Beschäftigung, die für sich selbst angenehm ist" (Kant 1968: §43) is correct. The last modification needed to Lotman's conception of games is replacing the element of make-believe by the Kantian criterion of being a pleasant action for and in itself.⁷ Games as secondary modeling systems of actions hold their twofold ontological and epistemic status only in connection with this Kantian insight, i.e. taking real rules serious but only in order to have fun. The Kantian remark should not be read in a psychological way. Otherwise we would be forced to say that a game stops being a game if someone doesn't enjoy playing it. There are many games I do not enjoy - still I do not like them *as games*. Saying *when* something *functions* as a game is not identical with saying which things are games. In this paper I have contented myself with the effort to contribute to the first task.

⁶ Cf. the growing demands that only amateur athletes should be participating in the Olympic Games in order to conserve the 'spirit' of the games. Cf. also the change in the use of ordinary language when talking about professional soccer players or musicians *practicing* where an amateur would still be *playing*. This is not to be taken as a clean-cut distinction since it is obviously possible for an amateur to be practicing and a professional to be playing.

⁷ I do not intend to establish necessary and sufficient conditions but rather to provide conceptual "symptoms" for games.

Games

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Duke Nukem 3D. 3D Realms/Apogee Games, PC, 1996.
Grand Theft Auto IV. Rockstar North/Rockstar Games, PC, 2008.
Tetris. Nintendo R&D1, Bullet-Proof Software/Nintendo, Game Boy, 1990.

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