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Article

The Typology of Representations in Computer Games

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The aim of this paper is to explore how Peirce's trichotomy of symbolic, indexical and iconic representations can be applied to computer games. I argue that if we use this classification, we gain the ability to make distinctions that game studies often ignore, or do not adequately grasp. To increase the descriptive power of Peirce's trichotomy, I suggest two additional distinctions: the difference between external and internal representations, and the difference between diegetic and non-diegetic representations. I combine all of these distinctions to construct a typology of representations in computer games. I argue that the application of this typology to particular elements of games (instead of games understood as a whole) enables us to solve some of the problems caused by the relationship of games to the external world. A case study I use to illustrate how my typology helps to improve game studies discourse, is LocoRoco—an abstract game accused of containing racist imagery. I argue that the game publisher's response to the controversy was inadequate, since the game content, due to the application of representational mechanisms, can be seen as racist even if its developers had no intention of creating such a racist content.

Keywords: games, representation, Peirce, art, aesthetics.

Introduction

The notion of representation belongs to the group of concepts that are notoriously difficult to explain and define. It has been said to be both vague and polysemous (Ramsey 2010). The notion remains to be hotly debated within philosophy of language, where the discussion often boils down to questions about linguistic meaning and reference**.** It has also been discussed in the philosophy of mind**,** where it concerns problems of mental representation, conceptualization, and internal modeling. In addition, the notion of representation is one of the central concepts used in aesthetics, as works of art are often said to represent reality.[1] Still, it can be argued that as problematic as it is, it is very hard to imagine how this concept could be avoided or exchanged for something less troubling.

The term "representation" is also very often invoked in the context of video games. One influential line of thought suggests that it should be eschewed in the context of games in favour of different terms, such as "simulation" (Frasca 2001b) or "virtualization"

[1] As pointed out by Umberto Eco, the relation between the notion of representation used in aesthetics and the one used in philosophy of perception remains to be discussed (Eco 1979).

(Kharhulahti 2015). Moreover, in a somewhat different sense, it is often discussed in the context of social critique, as many contemporary articles address the problem of representation of gender (Ivory 2006; Williams et al. 2009), sexual orientations (Shaw 2009) or nationalities (Wohn 2011). In most of these cases, the notion itself is simply taken for granted; for example, none of the cited papers explain the notion of *representation* as such. Most notably it is unclear whether the authors discuss a single notion or different types of representation instead.

Another issue is that it is not uncommon for game creators to deny that elements of the game are representations of some objects or, contrary, to insist that they represent some objects, even though the players recognize them differently from what they are told by the developers. This can be due to the fact that the developers lose a license they had at the beginning of the development period or because they add a new license keeping the original elements of the game intact. For example, *Super Mario Bros. 2* (Nintendo, 1988) is a game built on the basis of another intellectual property and, for this reason, contains many graphical elements with references and meanings that are incoherent with the rest of the *Mario* franchise. Another example can be found in *Die Hard Arcade* (AM1, 1996)—a game that used the license of the *Die Hard* movie series, but because of copyright reasons has been stripped from this license in its Japanese version. What should we treat as the "primary" representation in these cases—the audiovisual part of the game, such as the setting and the characters that seems to refer to one set of objects—or the textual information delivered by the title, that seems to refer to elements of a movie?

A principled issue that applies to all computer games is whether only audio-visual and textual aspects of games contain potential for representation. What about the game mechanics? Can we say that the mechanics of a game *represent* anything?

Additionally, we may be also interested in a historical question about the evolution of the medium—how does the potential for types of representation in computer games change? One obvious answer to this question is that games proceeded from textual to photo-realistic representations, but are there any other forms of representation that have emerged through the development of the medium that can be found and studied by game historians?

I believe that all of these questions demand more complex answers and that they deserve papers of their own. The aim of this paper is to prepare a philosophical ground for examining the issues posed above by addressing the following question: What types of representations are found in computer games?

The framework I propose will serve as a map of types of representations that could answer some of the fundamental, ontological questions about representations in computer games, such as: What criteria must a game element meet for it to be a representation of something?

How do we recognize which objects the game's elements represent? Are there many ways of representing, and if so—how many? In the conclusion, I will sketch some possible applications of the framework that will hopefully inspire further research.

The main idea of this paper is to examine the possibility of application of the seminal Peircean trichotomy of *symbolic*, *iconic*, and *indexical representations* in the context of computer games. Although I plan to keep the gist of the original trichotomy more or less intact, I wish to point out that the three notions will be used in their contemporary senses which sometimes differ from what Peirce (most probably) intended. To be more precise: I understand symbolic representation as the relation between conventional signs and their reference, indexical representation as a causal representation between objects, and their causes, which can be used by cognitive systems as proxies, and iconic representation as a relation of structural similarity between a proxy and its target. I explain the way I understand all three types of representation in the following section.

The structure of the paper is as follows: In the section entitled "Peircean trichotomy", I introduce the basis of the framework, that is, the Peircean trichotomy of types of representations. In the following section, I clarify how the notion of representation put forward relates to Kendall Walton's theory that representations are props for make-believe. Additionally, I introduce the distinction between internal and external representations, as well as the difference between diegetic and non-diegetic representations, which are needed for the framework to function. The framework itself can be found in the section titled "Trichotomy at Work". The subsequent section titled "Representations Combined", discusses the possibility of combination of different types of representation, namely situations in which a given object represents its target in more than one way. In the last section, I show how the resulting framework could be applied to the analysis of computer games.

Peircean trichotomy has already been discussed in the context of video games.[2] Two notable examples can be found in the works by Clara Fernandez-Vara (2011) and in William Huber's doctoral dissertation (2013). I discuss Fernandez-Vara's idea of indexical storytelling in the section devoted to indexical representations. The combinatorial application proposed by Huber is fairly close to what I wish to achieve. In the early parts of his dissertation, he presents a combinatorial view of types of representations based on the features of their targets Huber 2013, 38) and shows how they can be applied to certain selected games. This part of his work functions only as a building block of a larger project, so the analysis of the topic in question does not go much further.

[2] The distinctions themselves were also invoked without making the explicit connection to Peirce, see (Caracciolo 2009).

What I wish to achieve in this paper, is to combine Peirce's trichotomy with two other distinctions, on the one hand the distinction between internal and external representations, and on the other hand, the distinction between diegetic and non-diegetic elements of games. On the basis of this, I will build a formal classification framework capable of differentiating between multiple types of representation that can be found in computer games.

Peircean Trichotomy

Let me start with a general notion of *representation* that I am going to apply in this paper. Representation is analyzed in terms of a three-argument relation between a given object, its interpreter, and its target. What this relation establishes is that (at least to some extent) the interpreter can use the object as a proxy for some external target. What it means in the context of a computer game, is that the user can manipulate a given machine state as a proxy of some other object, which can be another machine state or any external object. For example, the user can manipulate a number that represents a future date in her calendar.

Peirce differentiates between three types of representations, depending on the way the object is connected to its target.

In the case of indices, the mechanism for connecting the representations to their targets is found in the causal relation between them. Animal tracks are a typical example of a representation of this type. Needless to say, this causal relation can then be recognized and exploited by the user of the representation. For example, an animal which senses the scent of a predator, may change its course even though it did not see the predator itself. This form of representation may seem a bit peculiar, as we usually assume that representations are created artificially. Still, Peirce's intuition becomes clear once you think of the notion of representation in a very general manner—an object is *represented* (instead of being present) if it is related to its target in such a way that it can function as a proxy for the user of the representation. Needless to say, the proxy is not a perfect substitute for its target. A hunter will not attempt to shoot the tracks of the animal, but she will follow them, just as she would follow the animal. Natural, non-conventional representations have been neglected in the philosophical literature for some time, but their importance has nowadays been restored (Fodor 1998, Dretske 1988, Field 1978). It is also crucial to remember that the causal connection in question should be understood broadly—as any physical influence of the target on the representation.

Iconic representations differ from indices in that the mechanism of the former is not based on physical causation. Instead, it is based on similarity between representation and its target. This similarity can be straightforward in the case of a 2D projection of a three-dimensional object (a similarity of a picture with what is being pictured) or as sophisticated as in the case of a neural map stored in an animal's brain. Pictures and maps are the best examples of representations of this type.

Symbolic representations relate to their targets via some kind of convention. Linguistic representations can serve as the best example. They can be as simple as a single sign or as complicated as a detailed description. Note that signs used as representations do not have to be a part of any language. They can just as well be a part of a simple code[3].

All three above mentioned types of representations differ in terms of the mechanism which is responsible for the connection between representations and their targets. In the first case, this mechanism boils down to *physical causation*, in the second to *similarity*, and in the third to a *convention*. Note that although each of the three types of descriptions of representations denote a different mechanism, they are not mutually exclusive. Nothing prevents us from using a convention which builds upon an existing similarity or an existing causal connection. Think of onomatopoeias or hieroglyphs as examples of this.

A small difference to be noted is that symbolic representations differ from their indexical and iconic counterparts in terms of the role they ascribe to the user. In the case of symbolic representations, a conscious user with fairly sophisticated cognitive capabilities seems to be required, as these capabilities guarantee that a relevant convention is applied to the representation. In contrast, the requirements for iconic and indexical representations are much less strict. The reason for this is that the representing relation does not demand a convention, but stems from physical and structural properties of objects. As such, the connection between the representation and its target can in principle be recognized by much less sophisticated representation users. For example, a child who does not yet read cannot perceive much of what makes it possible for the adult to orient in the city, for instance, the signs, the symbols, and the words on the street labels. Still, it is possible for the child to recognize similarity between a picture and a person represented in a picture (iconic representation) or to react to smoke as a sign of fire (indexical representation).

Up to this point, I have referred to the three types of representations in their original Peircean sense. Still, as mentioned in the first section, historical comparison is not the aim of this paper, so I take the liberty to adopt liberal interpretations of the types in question as long as they produce interesting and warranted distinctions which facilitate the study of games. For this reason, in the case of iconic representations, I prefer to steer away from Peirce and abandon his broad notion of “similarity”, which boils down to the idea that objects are similar whenever they share some properties. Instead of general similarity, I prefer to focus on a more precise notion of “structural similarity” known from philosophy of mind and cognitive science (Cummins 1989). In short, a given object A can be said to

[3] Code systems, such as the system of road signs, differ from languages in that they are not compositional – they allow only for a finite number of messages.

be structurally similar to a given object B if there exists a nontrivial homomorphism between A and B.[4] There are two important reasons why I prefer this notion.

As mentioned, the first reason is that the notion of "structural similarity" is much more precise than simple "similarity". The application of this notion helps us to avoid the standard critique of iconic representations that points out that the notion is simply too broad. This criticism has been put forward in the philosophy of mind (Putnam 1998) as well as within aesthetics (Mitchell 1987, Eco 1979). Needless to say, just like in the case of general similarity, structural similarities are typically very easy to construct as it is possible to find many structural similarities between two randomly chosen objects. A general solution to this problem may be too complex to articulate, but in the case of computer games, the situation is much clearer. Even if it is true that a given structure present in a computer game can be structurally similar to multiple targets, the interpretation is typically narrowed down by using additional symbolic representations. Apart from seeing game objects, the player is often also told what she is *supposed* to be seeing via labels, character dialogue, etc.

The second reason is that the notion of structural similarity is much better suited for the explanation of the notion of "simulation", or a "model", which are crucial for the discussion of representations in video games.[5] The original notion used by Peirce focused on visual similarity. The notion of structural similarity that I choose, however, does not prefer visual properties. This choice is mostly motivated by the success this notion has achieved in discussions on representation in cognitive science, (see Cummins (1989)), but it is also very easy to see that it is better suited for the study of games. For example, by using the notion of structural similarity, we can easily say that an economic model present in a game is similar to the real economy. This approach goes against some of the views expressed by game scholars so it may be important to support it with additional argumentation.

Contrary to Frasca (2011b), I see no reason to treat representations and simulations as opposites. It seems that the main reason that Frasca treats them as opposing categories is that he identifies representations with narratives. As already mentioned, I use the term *representation* the way it is used in cognitive science—as any state or object that can be used as a proxy in cognitive processes such as identification, understanding or association. If we understand representations this way, simulations are simply a subset of possible representations. They are dynamic representations, or representations of processes.[6]

[4] I cannot discuss the notion of nontriviality which is used here in more detail due to space limitations. The main intuition is that a nontrivial similarity is a similarity which does not occur between a given object and anything else.

[5] This aspect of games has been pointed out very early, see Crawford (1984). The relation between simulations and representations can be presented as more complex, for example, Uricchio (2011) says that simulations are machines for producing representations.

[6] A similar argument is made in (Tavinor 2012)

Some game scholars have suggested replacing the notion of “simulation” with other notions, such as “metaphor” (Moering 2013) or “virtualization” (Kharhulahti 2015). Yet, if we conform to the way simulations are understood in contemporary philosophy of mind and in cognitive science, we may be able to avoid the challenges these authors point out. For example, the main point raised in Kharhulahti (2015) is that simulations differ from games because simulations and models have an instrumental purpose that games lack. As has been shown by Fizek (2016), this view on science is rather artificial as the actual scientific practice often employs playful usage of models and simulations. Kharhulahti’s claim above can be seen as an extension of a more general intuition that games cannot be seen as simulations as they do not attempt to simulate reality (Giddings 2014).[7]

It seems to me that this line of reasoning is based on a misunderstanding and that the model I present below helps to avoid it. It is true that most games do not promise to simulate reality. It is nonetheless also true that some of their elements do simulate reality and are often advertised as doing so. Games strive for “selective authenticity” (Shaw 2015). The best example of this trend can be found in physics engines since the way they are evaluated is typically based solely on whether they recreate real life physics. My model helps to explain this clash of intuitions because it enables us to talk about realism in a more granular way. Even though whole games taken as such are not presented as simulations or models, there is nothing that prevents their creators from treating their elements as representations or simulations. For example, even though *Rocket League* (Psyonix 2015) is not presented as a representation of a real sport, it is still possible to ask if its physics system is realistic.

Setting the Stage

Before we proceed to the adaptation of the Peircean trichotomy[8] to video games we need to address some preliminary distinctions and concerns. First and foremost, it is important to point out how the framework I propose differs from Walton’s account of representations as props (Walton 1990), given how influential it is in game studies.

Even though Walton’s theory was not created to describe games, there are many points of connection. Games serve as a starting point of the theory (Walton 1990, 4)[9] because Walton assumes that objects used in games function merely as props and extrapolates this observation to less intuitive cases of objects presented in paintings, poems, novels, and movies. In addition to this, the key notion of “make-believe” that Walton builds his theory on, originates from children’s games. Walton’s theory has also been directly applied to games by Chris Bateman (2011) and the latter argues that the original account does not

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[7] Kharhulahti (2015) notices this connection in his paper.

[8] Note that I still use the term “Peircean trichotomy” even though I modified it slightly by switching general similarity to structural similarity. I believe that this modification is sufficiently minor to warrant this.

[9] Walton does not talk about digital games, but the difference between digital games and non-digital games seems to be negligible for the purpose of this discussion.

require substantial modification to describe games. In addition to this, in a fairly recent publication, Walton directly endorses the view that games and sports can be seen as analogous to stories in the sense that they are also based on pretence and make-believe (Walton 2015).

Interestingly enough, when discussing the way that the notion of representation is used in philosophy (Walton 1990, 111), Walton mentions all three types of representations that I listed above.[10] Yet, he seems to believe that in some cases, in order to be a genuine representation, all of the three mechanisms of representation have to be involved. The example he uses is a portrait of a man. Initially, we may think that if the portrait matches him, it can be called a representation of him (this would correspond to the Peircean iconic representations). However, imagine that the man has a twin brother. The portrait matches him as well. But this portrait cannot be, in Walton's opinion, called a representation of his brother. What is lacking is the causal connection to the pictured man (which corresponds to a Peircean indexical representation). Yet, even this causal connection may not be sufficient. If the artist uses a model, but labels the portrait with a different name (which corresponds to a Peircean symbolic representation), the picture will be interpreted as a representation of the bearer of the name written on the label, not as the representation of the model. In order for the representation to work as intended, that is, to refer to the right object, it has to contain a combination of all the three mechanisms. This means that even though Walton recognizes all of the three representational mechanisms in the Peircean trichotomy, he does not want to treat them as subtypes of representations, but rather as constituents of what he treats as genuine representations.

It is nonetheless crucial to note that all of my considerations above only relate to the general, philosophical understanding of representation[11] that Walton wants to distance himself from and which I, in contrast, embrace in this paper. The most important difference is that Walton's notion of representation is purposefully non referential. The reason for this, is that Walton wants to reserve his notion of representation to fictional worlds only (Walton 1990, 3). Representations are props used in the game of make-believe, regardless of their connections to the real world. What it means for us, is that despite terminological similarity, and the fact that Walton's theory seems to be easily applicable to games, it has, in fact, less use for our current purpose. The classification framework I am proposing treats representation as referential. In this connection, I am interested in the relations between game objects and their targets. The question of whether elements of games refer to some fictional objects as well, is a different matter that will not be discussed in this paper.

[10] Although he does not mention Peirce and uses a different terminology.

[11] As I pointed out in the first section, a general notion of representation is a relation between three objects: the target, the representation, and the interpreter. The representation is an object which functions as a proxy of the target for the interpreter.

Expanding this framework so it covers reference to fictional objects should be possible, but this requires an account of fiction—a task that goes beyond the scope of this paper.[12]

Lastly, although I leave all three Peircean types of representations mostly intact, the only difference being a different choice of similarity relation, I do not believe that they cover the complete spectrum of possible interpretations of the notion of representation as it is used in video games. On the contrary, it seems very plausible to me that some additional types of representations could be added to the classification in the future.

It is also worth adding that there exists a very interesting connection between iconic representations and metaphors. Some authors use these terms interchangeably, or suggest that one is a subspecies of the other,[13] but I do not believe that such a reduction is possible as it makes pictorial representations very difficult to explain.[14]

As enlightening as the original Peircean typology of representations is, its descriptive power is limited since it contains only three types. To make the ontological framework for categorization of game representations more robust, I will combine Peircean typology with two additional distinctions. The aim of this addition is to make a typology capable of differentiating between more representation types. As we are going to see in the following section, they will function as subdivisions of Peirce's types of representation. Taken together, they allow us to create a more robust categorization of representations in games.

The first distinction relates to the localization of the representation's target. As we already saw in section one, representation exhibits a relation which connects three entities. Whenever we say that A represents B for the user C, what we mean is that A stands for B to the user C or that A is a proxy for B for the user C.[15] Taking this into account, we may now differentiate between two situations. On the one hand, the target entity B can be either an *external* object, or a *part* of the object A itself. In other words, it can be located either externally or internally. This distinction is crucial for any referential theory of representations as it is introduced as a natural consequence of the fundamental difference between users of representations and their environment. For example, when I talk about my hair, or a pain in the ankle that I am feeling, I use symbolic representations of targets internal to my own body. In contrast to this, when I talk about my house or my clothes, I am referring to targets external to my own body. Although, in some cases the distinction

[12] In order to prevent confusion, it is worth pointing out that even though Walton reserves the notion of representation to fiction, he does not believe that props refer to fictional objects. The reason why Walton subscribes to this view on fiction, is that he believes it to be more compatible with our ordinary way of speaking about fiction (Walton 1990, 390).

[13] See Bogost (2006) and Crawford (2003) for examples of this.

[14] For a thorough analysis of the notion of "metaphor" in the context of computer games, see Moering (2011).

[15] These relations are, of course, rather puzzling. How can A achieve this? Many theories, Peirce's trichotomy being just one of them, try to explain the mechanisms behind this "proxy" relation, but at this point the common expression "to stand for" will suffice.

between the internal and the external may be hard to pinpoint, it is, fortunately, rather easy to grasp in the case of computer games because what we need here is a simple difference of either being a part of a game (its mechanics, art, or code) or not being a part of it. Thus, a target B of an in-game representation A, can either be internal when it is a part of its mechanics, art or code, and external when it refers to objects apart from these elements. The inside/outside distinction should not be understood as being about inside or outside of the game world. Instead, it should be understood quite literally as being a part of a game's running code and stored data, or as not being part of it.

To talk about game objects being parts of the game world, or the game narrative, we need an additional distinction: the difference between *diegetic* and *non-diegetic* parts of the game. Originally introduced in film studies, this opposition has been applied to game studies (see Arsenault and Larochelle (2014) as an example of this) and should be fairly easy to understand. Diegetic elements of the game are those elements that are parts of its depicted world. Characters, buildings, guns, or monsters can all serve as examples of diegetic elements. The non-diegetic elements of a game are those elements which are recognized by the player, but are not part of the depicted world. Interface elements, background music, or menu options, can each and every one serve as an example of a non-diegetic element of games. Even though this distinction is fairly easy to grasp, it is definitely not without its problems, as there are many borderline cases where it is difficult to say if a given element should be interpreted as diegetic or non-diegetic. As Kristine Jørgensen (2013) argues, some game elements, such as the diamond shape hovering above characters in *The Sims* series, seem to be positioned between these categories. While I do agree that the distinction is far from perfect, I believe that it is still important as it functions as a better alternative to the notion of "interface". What makes the notion of diegesis useful in the context of representations, is that it helps to explain why it is fairly common for games to display jarring representational inconsistencies. For example, separating diegetic and non-diegetic layers of a game, helps us explain why there is nothing inconsistent in a game that combines medieval setting with modern iconography in its mini-map or a disk icon that signifies a saving option.

Trichotomy at Work

Taken together, both distinctions discussed above (external/internal vs. diegetic/non-diegetic) produce a two-dimensional matrix of possible cases which can then be used to supplement our three types of representations. This juxtaposition of distinctions gives the original trichotomy much needed subtlety since if taken in its original form, it could easily be seen as too coarse grained. The ability to increase granularity should become rather clear once we look closer at some examples. In order to show the ability to make more fine-grained distinctions, I propose to go through all of the possible combinations and analyze them in concrete examples.

Symbolic Representations

As explained in the second section, symbolic representations are to be understood as representations which are related to their targets via some kind of linguistic or non-linguistic convention. Symbols can be a part of a natural language, a simplified code, or convention explained in a manual or a game tutorial. The only crucial point is that the mechanism responsible for the representation relation calls for an external arbitrary convention. Typically, these labels help us to identify certain game elements and to relate them to their targets. But as pointed out by Daniel Vella (2014), they can also carry additional information such as the indication of gender or social status for avatars or non-player characters. Once we consider divisions of internal/external and diegetic/non-diegetic, we can consider four separate types of symbolic representations depicted in Table 1. Let us analyze them in more detail.

Internal, Non-diegetic Symbolic Representations

I believe that it would be best to start with the case of internal, non-diegetic symbolic representations, as it is probably the most intuitively understandable category (the upper right part of Table 1). We are thus interested in such constituents of the game that are not a part of the interface, and which refer to some in-game elements. Consider the example of an ammunition counter. In a most straightforward case, it consists of two parts: a number and a word “ammunition” or “ammo”. It is obvious that the direct usage of the word calls for a specific linguistic convention in order to account for the meaning of the representation. Obviously, the representation is internal since the magnitude it represents is simply one of the mechanics of the game. Also, note that without this prior knowledge of conventions, the interpreter of the representation would have been completely oblivious to what it means. It is quite easy to overlook this fact because linguistic conventions are so ubiquitous in our environment that we often are not aware that we treat them as conventions, and that we tend to think about them as if they were immediately perceived. This need for conventions may be a bit less obvious in the case of the numerical part of the ammunition counter. Our ability to interpret that the ammunition counter signals a decrease in ammunition, requires us to understand the numerical system utilized by the interface, as well as the fact that the decrease in numbers refers to the decrease in the ammunition numbers (which is, of course, another linguistic convention).

As pointed out above, the convention used to decipher a symbolic representation in a game does not have to be linguistic at all. An example of this is found in the case of color coding such as differentiating between popular exhaustible resources such as health or so called “mana”. Even though not linguistic in nature, this convention has to be explained to the player in paratexts (manuals, on-line tutorials, arcade flyers, etc.). And even if the convention sometimes becomes so ingrained in a given genre that it does not have to be explained anymore (think of an energy bar in a fighting game), it had to be properly presented in the earlier games. Labels and tooltips which help the player discern different objects in the game, is another fairly popular example of symbolic representations realized through the game's interface. They can be embedded in the game in a variety of ways. Sometimes they are simply displayed besides the relevant game objects, for example in the case of an inventory screen, and sometimes they can be switched on and off by the user, for example the "alt" key used in *Diablo II* (Blizzard North, 2000). Also, they can even be responsible for all the representational work—sports management games can be a good example of this as they often present matches (or races) as sets of identical dots with labels attached to them.

The last group of internal non-diegetic symbolic representations can be best illustrated by the notion of experience levels. The main idea behind this category, is that the represented object, in this case the experience of the game character, is perceivable or accessible to the player only through the interface and not directly. In order to get a better understanding, contrast this situation with the ammunition counter we started this section with. If the player did not have the support from a symbolic representation, she would still, at least in principle, be able to count the number of bullets she has left in the clip.[16] But no such thing could be done with the experience level—it is a hidden game mechanic visible only through the representation in the interface.

External Non-diegetic Symbolic Representations

The next category I would like to discuss is the case of external non-diegetic symbolic representations. What we are interested in, is non-diegetic parts of the game that refer to something outside the game via some linguistic convention. Contrary to the previous set of examples, it is fairly difficult to find suitable examples of representations of this type. One example which comes to mind, is the date/time feature available in some of the games (presumably to help the player keep the track of time during long sessions)[17]. Another good example of this, are company or organization logotypes displayed in the game menus[18].

External Diegetic Symbolic Representations

The same logos can, of course, be displayed in-game, for example on the stadium advertising panels or on billboards, thus becoming diegetic external symbolic representations. Another good example of such representations can be found in the usage

[16] The easiest way to imagine this, is to think of the way we can use a double-barreled shotgun in FPS games. It is rather easy to remember whether we have two or one shell left without looking at the interface.

[17] Gran Turismo 5 (Polyphony Digital, 2010) is an example of this as its interface contains the real-time clock synchronized with the console clock. It is also worth noting that some of the logotypes can be iconic instead of symbolic.

[18] For example, in basketball titles where the player chooses teams, their names are often represented by their real logotypes displayed in the game menu.

of proper names which is especially obvious in the case of historical figures. Consider *JFK Reloaded* (Traffic Software, 2004) which refers to John Fitzgerald Kennedy as an example.

Illustration 1. Real company names as an example of external diegetic symbolic representations (Electronic Arts, 1994)

Internal Diegetic Symbolic Representations

Obviously, the characters, objects, or places mentioned by name, are often present in the game, and in these cases, they can be said to be symbolically represented in it as internal diegetic representations. For example, the characters in the *Assassin's Creed* series are often mentioned in the games they figure in. The same can be said about some of the company logos—they can be symbolic representations of in-game companies[19]. Note that, as I pointed out in the third section, the difference between internal and external representations should not be conflated with the division between actual and fictitious companies. Actual car manufacturers' logos in racing games can just as well be both internal and external diegetic symbolic representations.

[19] *Portal's* "Aperture Science" logo (Valve, 2007) can be a good example of this.

Illustration 2. “Aperture Science”—a fictional institution logo featured in Portal (Valve, 2007) as an example of an internal diegetic symbolic representation.

The table below presents a quick overview of different subtypes of symbolic representations that result from combining the distinctions of internal/external and diegetic/non-diegetic representations.

Table 1. Summary of symbolic representations

	Diegetic	Non-diegetic
Internal	“Internal” Company logos “External proper names”	Ammunition counter Color coding (mana/health) Game object labels Experience level
External	“External” company logos “External” proper names	Time of day

Iconic Representations

As mentioned in the first section, iconic representations should be understood as nontrivial homomorphisms between game elements and the structure of their targets. It is preferable that we understand these types of representations by a guiding example, for instance, the relation between a building plan and the building itself. Note that the building plan is not trivially similar to the building interior. Reading the plan demands for certain cognitive capabilities of the user. That is why the building plan differs from a photograph from the bird's-eye view. Nonetheless, the structural similarity between the plan and the building interior is not just a matter of convention. It could, in principle, be discovered by the user because the representation relation is not imposed by the users via social contract—as it is done in the case of symbolic representations.

There are two features of iconic representations that make them unique. First, unlike symbolic representations, they can be manipulated by their user in order to discover new facts about their targets. For example, the user of a building plan can easily discover the position and layout of a room she has never visited. Second, an iconic representation can be used as a representation of any given object that happens to be structurally similar to it. If the plan I am using ends up being similar to the building I am exploring only due to a sheer coincidence, then it can still be used as a decent representation of the building. It is the similarity that counts, and not history, causal relations, and so on.

Similarly to what I presented above, I shall now have a glance at all four possibilities generated by the internal/external versus diegetic/non-diegetic distinctions.

Internal Non-diegetic Iconic Representations

Since I already used the example of a map, it is not hard to foresee that in-game maps can serve as a good example of iconic representations. Since most of the time they are presented to the player as a part of an interface, which is not accessible to the game character, they should be grouped under the label of internal non-diegetic representations. Note that this applies both to fully developed map systems, often capable of scaling and rotating the maps, such as the one found in *Doom* (iD Software, 1993). Another example is the so-called "mini-maps' that consists of fragmental maps embedded into the interface, for example *Grand Theft Auto III* (DMA Design, 2001).

Internal Diegetic Iconic Representations

There is nothing that prevents the developers from creating diegetic maps. Such solutions have been successfully applied in games like *Far Cry 2* (Ubisoft Montreal, 2008) or *Metal Gear Solid V* (Konami, 2015). Sometimes it may not be clear whether this is the case. It is for example not obvious whether the map in the *Assassin's Creed* series should be understood as a part of the *Animus* simulation or not—but the difference itself should be easily understandable. Another rich source for examples of internal diegetic iconic representations are paintings or pictures of game characters and objects. Oil portraits in *Dishonored*, or ID photographs of immigrants in *Papers Please!* (Lucas Pope, 2013), are good examples of these kinds of representations.[20]

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[20] The latter example is especially good for our purposes as the game specifically demands the player to recognize discrepancies between ID photographs and the appearance of document owners.

Illustration 3. A map and a GPS system from Far Cry 2 as an example of an internal diegetic iconic representation.

External Diegetic Iconic Representations

External diegetic iconic representations are arguably the most interesting category as it relates to the most salient and unique aspects of video games, that is, their capability to dynamically model objects and processes outside the game. This is also where the notion of iconic representations seems to be the best fit, as this is how it is typically used outside of game studies. For example, in cognitive science, iconic representations are often said to function as mental simulations of represented processes.[21] Similarly, representations in games not only contain three-dimensional models of objects, and their two-dimensional representations, but they often include full-blooded simulations of their physical and social dynamic properties.

The fact that iconic representations can function as simulations, purchases us a lot of explanatory power, as we can now show why elements of video games can be used in significantly more sophisticated ways than we are able to do with mere iconic resemblances. Since I consider this aspect of iconic representations to be very important I shall elaborate further on this. The best way to understand this aspect, is to realize that game objects are not simply just simulations themselves, but should be treated as virtual counterparts to physical models and their simulations. Such virtual counterparts to models

[21] Although this approach has also been successfully employed in game studies, see Boyd (2009) for an example of this.

and simulations are not peculiar to computer games: toys, installations, mechanized train sets, all count as examples of such virtual counterparts, and we know them pretty well.

Once a toy comes into existence, it starts, so to speak, to live its own life. A gun made out of Lego bricks can be modified to such an extent that it loses the connection with its initial target, or such that it stops being structurally similar to a real gun, or reveals something its user did not know about guns.

As evidenced by the examples I have proposed up to this point, there is nothing distinctive to virtual models used in video games that separates them from physical models. There are, nonetheless, two specific features of virtual iconic representations that separate them from toys.

First of all, since virtual objects are not bound by actual physical laws, they can easily be used in counterfactual situations which are very far from what is actually the case. Second, computers allow us to model and simulate much more complicated systems than physical toys allowed for. For example, it would be rather difficult to imagine what a physical toy simulating the economy of an entire city would look like. But there is nothing that prevents us from creating a game simulating a city.[22] Similarly, even though sophisticated dollhouses existed for centuries, they were never able to autonomously simulate the interrelations between their inhabitants the way *The Sims* does (Maxis, 2000).

Iconic representations get their representational power from the similarity of structure with their targets, and not merely from the intentions of their creator to depict specific scenarios. For this reason, they may be exploited in a way that can be surprising even for the designers. For example, if someone learns a particular strafing maneuver because she has learned this trick in a racing game, she will be exploiting a homomorphism between the virtual and physical street in an unexpected way. In consequence, every game using graphics contains many potential iconic representations waiting to be recognized, utilized or even exploited. The point is that, just as with iconic representations that can be found outside of games, simulations can be used as models of reality. This gives the users of the models the ability to gain new, non-trivial[23] knowledge about the targets of these representations. Contrast this with games which contain only few (or no) models of reality. They do not give the users such possibilities. Think of a game with purposefully bad—no matter how you use it, there is no way of cashing out the knowledge you gain on object collisions in the actual world. *Surgeon Simulator* (Bossa Studios, 2013) is a good example of this.

[22] Yet, ideas similar to this one are sometimes entertained in science fiction, for example in Stanisław Lem's *Cyberiad* (Lem 1974).

[23] Saying that this knowledge is non-trivial is a bit vague. What I mean, is that the knowledge the user of the model gains, could not easily be gained from other representations. To use a more technical notion, the model is similar to its target in Tversky's sense; it is not only similar to it, but also dissimilar enough from other objects. (Tversky 1977).

Illustration 4. A model of the Pharos of Alexandria featured in Assassin's Creed Origins (Ubisoft, 2017) as an example of an external diegetic iconic representation.

External Non-diegetic Iconic Representations

Last, but not least, some non-diegetic parts of the game, for example parts of its interface, can be related by a homomorphism to their targets. A simple and rather obvious example of such a relation would be the relation between depictions of gamepad buttons in the interface and the real buttons. Even if the buttons themselves are differentiated by use of symbols (for example A,B,X,Y letters used in *Microsoft* and *Nintendo* accessories), the interfaces contain more than the symbols, since they may try to mimic the shape and the color of their targets.

The table below presents a quick overview of different subtypes of iconic representations that result from combining the distinctions of internal/external and diegetic/non-diegetic representations.

Table 2. Summary of Iconic representations

	Diegetic	Non-diegetic
Internal	In-game GPS system A painting of a game character	An in-game map
External	Models and simulations	Button pictures

Indexical Representations

As explained in the second section, indices should be understood in the following manner: An object A is an indexical representation of an object B if it is caused by B. What ties representations to their targets is thus a physical cause and effect relation that obtains between representations and their targets. Though, it needs not be a recurring or stable correlation. In fact, the causal relation can be instantiated only once, i.e. at the moment assets for the game were created.

Contrary to symbols and icons, the application of indices to video games seems rather counterintuitive and for this reason it is rarely discussed. One exception to this comes with Clara-Fernandez Vara's notion of "indexical storytelling" understood as a refinement of "environmental storytelling" (2011). Since Fernandez-Vara's understanding of indices is significantly different than the one I use in this paper, it may be useful to quickly explain the difference between our accounts before I proceed to discuss specific examples.

In a nutshell, Fernandez-Vara's idea refers to the way the player interprets the game environment in order to discover parts of the narrative. This typically boils down to observing traces and inferring their causes. To use one of Fernandez-Vara's examples, the observant player who explores the dystopic world of *Bioshock* (Irrational Games, 2007) can easily learn about the events prior to the downfall of the depicted utopia.

The crucial difference between indexical storytelling and indices that I analyze in this section, is that the former relies on previous knowledge of causal relations. As Fernandez-Vara (2011) acknowledges, in these situations the player uses her real-life experience to draw conclusions. When a player discovers smoke at a distance, she uses her knowledge of real-life indices and transfers this knowledge to the game**,** concluding that something was burning. This previous knowledge is indirect and the computer-generated fire may not actually be causally connected to the computer-generated smoke. What takes place in Fernandez-Vara's example, is a complex process of using two types of representation. The player observes a game state and recognizes it as an iconic representation of some real-world state. In this case, she recognizes computer generated smoke as structurally similar to real smoke. Next, she realizes that the real smoke is typically causally connected with fire, something which leads to the conclusion that there must have been fire in the game world. This adds another level of complication as the player does not have to expect that there was ever an instance of fire in the simulated world of the game, that is, that the developers had to program a fire sequence. The player may just as well assume that the fire happened only in the game's fictional world. Since, as I already mentioned, I wish to leave the questions regarding the game's fictional level aside, I analyze indices as literally causal. Similarly to what I did with symbolic and iconic representations, let me now look at some examples of subcategories of indexical representations in games.

Internal Diegetic Indexical Representations

A good way to illustrate the idea of causal connections doing the representational work, is to use the example of the changes in appearance and movement of characters in *Resident Evil 4* (Capcom, 2005), or the changes in the portraits in *Street Fighter II* (Capcom, 1991). The latter game changes the look of the characters to reflect their health state. The former game goes even further than the latter by making the character limp when injured. Just as in the case of real-life symptoms, the reason why these representations work is not simply because they are connected with the target by a convention or similarity. Instead, there exists a causal link between the part of the code that computes the health of the character and the code responsible for the look of the character.[24] Similarly, whenever the player collects certain objects that give her temporary beneficial capabilities, their appearances change in order to signify this effect, for instance, that the player attains invincibility. Another example of this type of causal link between machine code and the graphical representation, can be found in multiplayer games, such as *Fortnite* (Epic Games, 2017), in which the scattered inventory of players signifies that someone has died at a given spot. In this case, the connection between the representation and the target is not based on any linguistic convention or on similarity. The player learns of a state of affairs signified by the objects by observing a causal association between the objects in question and some game mechanics.

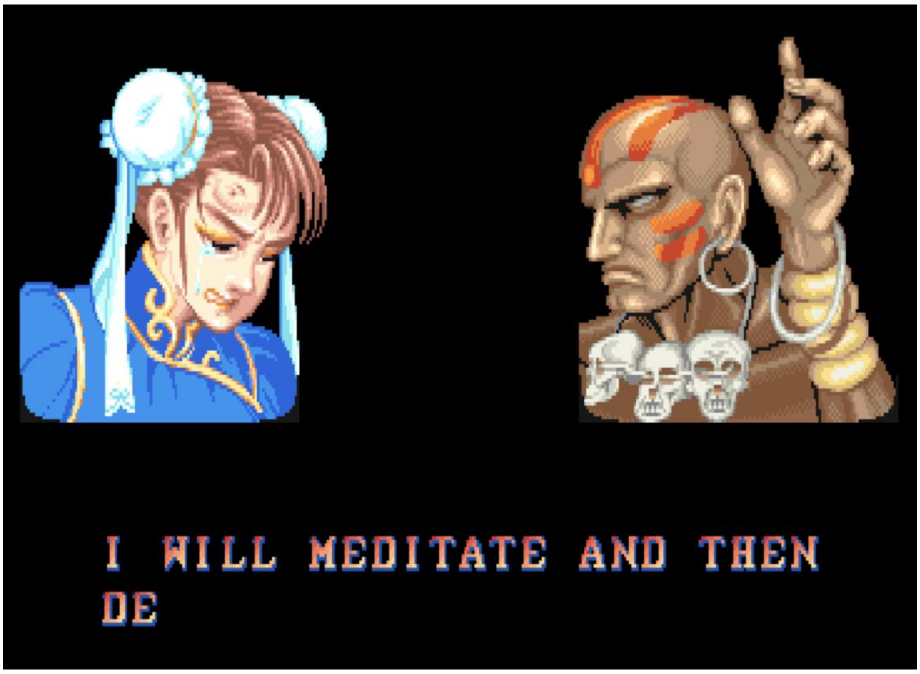

Illustration 5. A beaten-up character close-up in Street Fighter II as an example of an internal diegetic indexical representation.

[24] More specifically, it is a causal connection between two physical states of the machine that implements the code of the game.

Internal Non-diegetic Indexical Representations

Note that it is fairly easy to recognize an instantiation of non-diegetic indexical representations, as they often accompany diegetic indexical representations. For example, the change in visual appearance of the avatar that signifies the change in health can just as well be displayed as a part of a game interface. *Wolfenstein 3D* (iD Software, 1992) can be a good example of this. A related common example of an indexical representation embedded in the game interface, is the usage of bars or counters which decrease or increase in real time indicating the processes of losing or gaining various resources, such as the player's health, ammunition, and so on.

Illustration 6. A beaten-up B. J. Blazkowicz as an example of an internal non-diegetic indexical representation.

External Diegetic Indexical Representations

The most varied category of indexical representations is the category of external diegetic indexical representations. These are the game elements that are parts of the game diegesis, but which simultaneously represent some external objects because of their causal history. The reason for this is that many assets used in video games are sampled or scanned from real life objects—textures and sound clips being prime examples of these. The techniques used for obtaining these assets give rise to causal links of the sort that define the category of indices. Consider some of the more recent techniques for creation of game assets, such as the use of photogrammetry for *Vanishing of Ethan Carter* (The Astronauts, 2014), or the laser-scanning used for *Forza Motorsport 4* (Turn 10, 2011). The first technique requires the developer to make a huge number of photographs of a given real life object in order to enable the artist to create an accurate 3D model of said object. The second technique produces a similar effect, an accurate 3D representation of an existing racing track, but the measurements are made on the spot instead of being calculated from the photographs. The point is that both techniques establish a causal link between a physical object and a virtual object in the game. In fact, every texture that has been created from a photograph can be said to be a digital representation of the object it was scanned from.

External Non-diegetic Indexical Representations

Contrary to the previous category, the usage of non-diegetic indexical representations seems to be rather limited. Some of the examples that come to mind are scanned portraits of units in strategy games that are embedded into the interface, or pictures of controllers and accessories used in game menus. A special case, which is interesting, as it nicely illustrates the idea of causal connection doing the representational work, is the usage of cameras to embed the player portrait in the game interface.[25] This last example shows that a given game object can be (and often is) a representation in more than one way. In this case, a portrait of the player serves both as an indexical and an iconic representation of the player. In the next section, I will explore more of these combinatorial possibilities.

The table below presents a quick overview of different subtypes of indexical representations that result from combining the distinctions of internal/external and diegetic/non-diegetic representations.

Table 3. Summary of indexical representations

	Diegetic	Non-diegetic
Internal	Deteriorated avatar Inventory scattered on the ground	Deteriorated avatar portrait Energy bar
External	Photogrammetry Laser scanning 3D scanning Sound sampling Textures	Scanned character portraits

[25] For example, this solution has been used in various sports games.

Representations Combined

Having a set of clear-cut distinctions between representational mechanisms and aesthetic roles, is all well and good and, as I have pointed out above, this is something Peirce's distinctions deliver. But there is also something to be said about combinatorial power of the framework and I believe that this is where the Peircean trichotomy of representational mechanisms really shows its capability in categorizing the representation types found in games.

As I will show in this section, not only do all of the eight possible combinations of our categories make sense in the context of video games, but they also enable us to explain some of the confusions which permeate the popular and academic discourses. To simplify the example, let us assume that we are interested only in the external targets and that we do not care for the diegetic/non-diegetic division. It is, of course, possible to create similar tables with different constraints. For example, a table reserved only for the non-diegetic representations may serve as a basis for a study of different types of game interfaces.

Let us begin with a situation when something is a symbolic, iconic, and indexical representation at the same time. As I mentioned in the previous section, some of the modern games use special 3D scanning techniques that causally connect real world locations and their objects to their in-game counterparts. The example I used was a racing track recreated for a modern racing game, such as *Forza Motorsport 4*. Ideally, the recreation is also homomorphic to the place it was scanned from, and if the creators secure the rights to use a given proper name, the object in question becomes a symbolic representation as well.[26] Real life locations, such as the Notre-Dame cathedral in *Assassin's Creed Unity* (Ubisoft Montreal, 2014), or the licensed cars used in racing games, are good examples of objects being represented this way. But sometimes, even though the creators intend to relate to a real object, they are not willing to use the object as a source of the assets.

In many cases game assets are not produced via processes that involve the targets they refer to, such as the aforementioned 3D scanning or sound sampling. In these cases, the in-game objects can still be called iconic and symbolic references but lose the indexical aspect. Consider an example of the in-game character that is modelled after a late person who did not take part in a motion capture session, such as Bruce Lee in *Bruce Lee: Quest of the Dragon* (Ronin Entertainment, 2002). In cases like this, the movement of the

[26] In these cases, as pointed out by Marco Caracciolo (2009), objects not only look like their counterparts – the interface tells us what they are. It is worth adding that the developers can sometimes get away with using a name that is sufficiently similar to the actual one. For example, *Sensible Soccer* (Sensible Software, 1992) uses slightly changed names of the soccer players in order to avoid license agreements. The names remain sufficiently similar for the players to easily guess the intentions of the developers.

character is clearly modelled after the original in the iconic sense, that is, it tries to be similar to it, but there is no causal connection between the two.[27]

Note that sometimes the question as to where the game assets really come from may be of importance to the player. Consider the following example: *That Dragon, Cancer* (Numinous Games, 2016) is an independent game depicting the last moments of life of a four-year-old child struggling with brain cancer. The game is narrated by the developer who reveals that this is an actual, real-life story of him and his son. In one of the most powerful and moving sections, the player has to endure a cry of the developer's son. This section is very unsettling as is, but I believe that it would become unbearable if the cry used in the game was to be sampled from reality.

Even though, as in the case of *Nurburgring* we just discussed, using the modelled object as a physical source of the representations typically increases the likeness of the representation to its target. The physical connection with the target is not by any means necessary. It can best be seen in the case of representations that are symbolic and indexical, but not iconic. Using these mechanisms were rather typical in the early days of handheld and mobile games because scanning photographs of real-life objects, and sampling sounds, didn't help much. The technical capabilities of the machines they were later used on forced the creators to produce versions so inferior to the originals that they hardly became recognizable to the user. One only needs to look at the character portraits in the GameBoy version of *Mortal Kombat* (Midway, 1993) for an illustration of this. And if we go back in time, to the early days of eight-bit computing, we will be able to find many examples of solely symbolic representations. This is because the limited capabilities of machines they were running on discouraged the use of iconic and indexical representations. To see this, consider early text-only adventure games, such as *Zork* (Infocom, 1980).

[27] Or rather, it exists only in a very weak sense because there exists some indirect causal chain connecting the object and the model (for example the creators looked at footage of the object they model).

Illustration 7. *Mortal Kombat* for the Gameboy.

In contrast to symbolic-only representations typical of early text adventures, objects found in modern games such as *Grand Theft Auto V* and *Vanishing of Ethan Carter*, use techniques that consist in sampling real life environments. This results in an uncanny likeness to these locations, but the designers intentionally hide the connection to the real world on the symbolic level. What this means, is that the objects can be seen as iconic and indexical, but not symbolic representations. For example, *Grand Theft Auto V* (Rockstar North, 2013) presents a fictitious city of "Los Santos" even though it reproduces huge parts of Los Angeles in great detail. *The Vanishing of Ethan Carter* faithfully reproduces parts of Poland, but presents these as fictionalized parts of the US. Thus, the combinatorial possibilities of the framework I present allow us to explain why we could simultaneously claim that these games are- and are not- representations of real targets. They are iconic and indexical representations of the places they were modelled on, but they are not symbolic representations of these places.

Another possible case, illustrated by purely iconic representation, is especially interesting as it is characteristic only of digital media. Sometimes in-game elements can be generated by the computer without any causal connection to their counterparts. Games with procedurally generated graphics are the best example of this category. Still, even if a given scene contains only procedurally generated graphics and sound, and even if it does not suggest any real-life targets by using symbolic representations (labels of any sort), it can still be said to represent objects in the iconic sense. Such is the case with *Proteus* (Key and Kanaga, 2013). This is a game that generates a simple, yet recognizable virtual island—complete with fauna and flora—but uses no actual labels. Thus, the fact that some of the objects represent real life targets, for instance, the fact that the users recognize them as "trees", "rocks", "clouds" or "rabbits", is possible solely on the basis of their structural similarity to reality.

Illustration 8. Procedurally generated shapes in *Proteus*.

And what about a representation that is purely indexical? These cases are probably much more common than we realize, especially once we focus on particular textures or sampled sounds. It is often the case that game assets are created by sampling or scanning real life objects, but that they are later used without any intention of representing these objects. A good example of this, is one of the sounds used in *Destiny* (Bungie, 2014). One of the sound engineers has revealed that the sound was created by a combination of the sampled sounds of crumbling tinfoil and of vegetables fried in a pan. We may wonder if there is still any sense in saying that these highly processed assets represent their original targets, but we can make a case that they do, once we realize that the sound could represent two different objects via different causal chains. In this case, we can say that it represents an internal game event due to a causal connection, and an external event that has been used to record it (Blaine 2016).

In the end, we may also wonder if it is even conceptually possible for some elements of the game to be completely non-representational. Procedurally generated abstract shapes, without any labels, might be considered to be close to this idea (Sageng 2007), but we could still argue that as long as they are recognized and categorized by the player, they are in some way *representing something* in the iconic sense. I will leave this question open as it deals with more fundamental philosophical issues concerning the nature of representation than the problems I am discussing in this paper.

Table 4. Summary of combinatorial possibilities of types of representations.

No	Symbolic	Iconic	Indexical	Example
1	YES	YES	YES	Nurburgring in Gran Turismo V
2	YES	YES	NO	Bruce Lee mocap
3	YES	NO	YES	Scanned portraits in GameBoy version of Mortal Kombat
4	YES	NO	NO	City in Agent USA
5	NO	YES	YES	Vanishing of Ethan Carter, Grand Theft Auto V
6	NO	YES	NO	Proteus
7	NO	NO	YES	A Texture scanned from a photograph of a material
8	NO	NO	NO	Possible?

Case Study: The Examination of *LocoRoco*

What we might gain from the framework I am presenting in this paper, is the addition of more granularity and nuance to the discussion of representations. This addition can be helpful in two problem areas.

First, it is crucial to remember that, in most cases, talking about “games” being representational or non-representational is not very fruitful. It is much better to focus only on selected elements of a given game. Doing this opens new possibilities for analysis, and enables a much more nuanced discussion on representation, as it resolves some of the apparent tensions that researchers struggle with. For example, the fact that a given game depicts a fictional world does not prevent us from discussing some of its representational elements, such as physics, economy, or character psychology.

Second, different types of mechanisms of representation (iconic, symbolic, indexical) result in different standards of evaluation, in other words, that we estimate what their target is in different ways. This is most clearly apparent in the case of iconic representations. The fact that they can be recognized and evaluated solely based on structural similarity with their targets, enables us to explain why it is sometimes possible to recognize a given game element as representational even though the conventional and indexical mechanisms are not present (or even try to point in a different direction).

Let me show this possibility of recognition with the help of an example of a game that, at least on the surface, does not lend itself to representational analysis because of its apparent non-representational aesthetics, which turned out being described as racist. *LocoRoco* (Japan Studio, 2006) is a game released in 2006 on Sony PlayStation Portable and remastered for PlayStation 4 in 2017. The game contains cartoony graphics reminiscent of children’s book illustrations. The depicted world is a mix of recognizable objects, such as flowers or berries, and abstract shapes that are difficult to classify. Almost all of the characters that are present in the game are idiosyncratic and have no structural similarity to external objects. This is further amplified by the usage of labels which are invented for the sake of the game: *LocoRoco* (the titular creatures the player guides), *MuiMui* (hidden characters the player collects), and *Mojo* (the adversaries). All of these labels function as names of fictional kinds, and are present only in the non-diegetic parts. The game is accompanied by a very distinctive soundtrack that uses songs performed in a mockup of a language created specifically for the game. This combination of non-representational elements (nonsensical labels, word-like sounds, and creature design) produces a feeling of an autonomous, isolated, fictional world.

Despite this, in 2006, the popular gaming press (Gibson 2006) argued that *LocoRoco* can be seen as racist. It has been pointed out that the characters *Mojas*—the main antagonists—are disturbingly similar to so-called "blackfaces" known from early cinema and XIX century theatrical productions. This similarity was first pointed out by Alejandro Quan-Madrid, a blogger posting on the gaming website 1up[28]. His claim that this part of *LocoRoco's* aesthetics is racist, has later been challenged by the popular gaming site Kotaku in two editorials. The first one (Ashcraft 2006) tried to explain the similarity of the character of Moja to blackfaces by appealing to cultural differences between Japan and the West. The second (Eckhardt 2006) one attempted to blame the blogger, suggesting that the actual shape in the game has no reference to the real world and that it can be interpreted in a multitude of ways. According to the author of the editorial, it is the *interpreter* who commits racism by imposing a racist association. The discussion resulted in the following official statement issued by Sony: "LocoRoco is a fantasy game geared towards a worldwide audience that takes place in a vibrant pastel world with colorful landscapes and characters and is not based on real-life places, people or things."[29]

[28] Unfortunately, the original post is not accessible anymore (even in an archived form). It is described in (Gibson 2006 and Ashcraft 2006).

[29] The statement has been issued to *Next Generation* magazine and reprinted in Wollenschlaeger (2006) and Cundy (2007).

Illustration 9. The character of Moja (in the middle) featured in *LocoRoco*.

There is no need to further explain that this is a very delicate matter which is difficult to handle for the publisher and developer, but it seems to me that having a more robust notion of representation can be of help in the case of this and similar controversies. The crux of the argument against Quan-Madrid's claim is that the world of *LocoRoco* is not meant to be realistic. It is not built to model reality. The classification framework I presented above, shows that Sony's answer is, at best, inadequate. First, as we have already argued, the fact that the game does not represent reality does not mean that its elements cannot make use of representational mechanisms. In addition to this, the fact that the developers did not have the intention to represent reality does not mean that they avoided all representational content.

The creators of the game wanted to depict a mysterious, unfamiliar, and self-contained world. For the most part they succeeded, but at least in some cases, they ended up including iconic representations of reality. For instance, small flowers that the player has to collect, look like poppies, and some of the creatures inhabiting this world are clearly birds. Should we prohibit these associations just because the world treated as a whole is not meant to represent reality? As we saw, objects can be said to be iconic representations of reality despite the intentions of their creators. At the same time, even though the representational link has been established on the side of the interpreter, this does not mean it was *created* by the interpreter since it is based on structural similarity, and not on free association.

Structural similarity may not be a clear-cut notion, but there is no doubt that it can be used to frame issues that pertain to representation in public discussion in a manner that can reveal the intuitions of the majority of the players. In practice, the use of the notion can be rather uncontroversial. In the case of the *LocoRoco* controversy, no one denied the structural similarity between Mojas and blackfaces. The similarity was acknowledged by most, but was downplayed as accidental by Sony and writers such as Eckhardt (2006) and Ashcraft (2006). According to the notion of iconic representations that I presented above, the accidental nature of similarity has no bearing on the representational link since the only thing that is needed is structural similarity. The upshot of this is that the claim that *LocoRoco* contains a racist representation of a black person is likely warranted. Needless to say, the fact that the mechanism of representation that I have used in this article does not require the intention of the creator, means that this conclusion does not imply that we can draw the conclusion that the developers are racist. All we can establish is that the controversy cannot be automatically dismissed, and that some action on the side of the developer, in response to the allegations, could have been expected.

One more aspect that makes *LocoRoco* interesting from the point of view of the study of representation, is the distinctive soundtrack. As I have already mentioned, it contains voices speaking in a fictional meaningless language. Unlike most game soundtracks, *LocoRoco*'s music is not instrumental and consists mostly of songs performed by child-like voices attributed to the titular creatures. The developers revealed in an interview (Accordino 2017) that this was a conscious tactic meant to strengthen the nonrepresentational character of the world. What is especially interesting for our purpose, is the process that led to the creation of the fictional language in question. The main game creator, Tsutomu Kouno, explained that he began the process by choosing words from many different existing languages, and then transcribed them into the Japanese *katakana*. In the next phase, he asked the Japanese singers to sing the words as they read them in their transcribed form. What the process means is that even though the language used in the game's soundtrack cannot be said to symbolically represent anything, it contains words that are indexical representations of expressions in many different real languages. The result of this inventive technique is that the songs give the player a paradoxical feeling of being completely alien and familiar at the same time. This interesting effect is possible because the process changed the sounds sufficiently to break the representational links, but kept enough structural similarities to their original targets to be almost, but never quite, recognizable.

Last, but not least, it is also interesting how much the game *LocoRoco* avoids symbolic representation, which is used only in the non-diegetic parts of the game. According to the developers, there were two reasons for this design choice. The first reason is already mentioned; the world depicted in the game was supposed to function as a self-contained reality disjointed from any real-world references. The second reason was that the creators sought to widen the appeal by avoiding language barriers. The result of this choice, is that even though the interface of the game contains very little text, the remastered version contains sixteen different language versions of the interface. This can be seen as a good reminder of the limits of symbolic representations, since they are always bound to particular linguistic conventions.

Conclusion

The discussion in this paper has revealed how computer games allow for different combinations of mechanisms of representation. In a dispute about the representational significance of gameplay and artwork in computer games, the parties may unwittingly use the notion of representation differently, for example by focusing only on the iconic, or only on the symbolic, aspects. While disambiguation of any technical notion is a worthy task in and of itself, I believe that this is especially important in the case of a notion as contentious as the notion of representation. After all, it is important to remember that some theoreticians disagree on whether some of these subtypes of representations should be called representations at all (Morgan 2014).

It is possible that the ability to distinguish between different types of representations can inspire future design ideas. As pointed out in the paper, the combinatorial framework gives us the opportunity to ask if the ability to generate content procedurally gives designers the possibility to create purely non-representational works of art. Perhaps the notion of indexical representations can be an inspiration for transgressive design—think of a first-person shooter game which, instead of boasting of how real the gunshots are, used samples of cries of real victims of war within the game.

To summarize, there are several advantages of the framework I am advocating in this paper. First, it shows that there are many types of representation, depending on the mechanism connecting objects and their targets, the localization of the target, and their relation to the game world. Discussing representations without indicating which type we wish to address, may result in misunderstandings. For example, when Espen Aarseth (2014) points out that game objects are often not representational, he cannot be thinking about iconic representations since these objects are often clearly similar to different targets. The point he is making is rather that in the case of computer games internal targets are more important than external ones.

This model shows that it is quite easy to satisfy criteria for representational targets. It is, in fact, difficult to create elements that are completely non-representational. The players' ability to recognize representations is typically due to their ability to identify all of the three types of representational mechanisms. The game elements reveal their targets to the player due to their structure, and similarity is often achieved because they have indexical references as well, and so on. Moreover, games contain symbolic representations which help the players focus on the correct structural similarity, for example, of labels. An important lesson to be learned from the model presented in this paper, is that intended or unintended discrepancies between symbolic, iconic, and indexical representations makes it impossible to provide a straight answer to the question: “What is this game element a representation of?”

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