This is not a Door:
an Ecological approach to Computer Games

Jonas Linderoth
Göteborg University
Box 300, 40530 Göteborg, SWEDEN
jonas.linderoth@ped.gu.se

Ulrika Bennerstedt
Göteborg University
Box 300, 40530 Göteborg, SWEDEN
ulrika.bennerstedt@ped.gu.se

ABSTRACT

In this chapter we outline an ecological approach to computer games and test out how the theory of ecological psychology can be used for understanding digital games and game-play. Ecological psychology holds that learning is a process of differentiating and not of interpreting or construing. Therefore semiotic/cognitive views on learning and perception with computer games, were the perceptual act is thought to be adding experiences to the things we see in a game in order to make meaning, can be questioned. The theoretical points are illustrated with data from an interaction study made on players playing the game *Timesplitters 2* on an X-box.

Keywords

Affordances, Computer games, Video games, Professional Vision, Ecological Psychology

INTRODUCTION – HOW DO WE PERCEIVE AND LEARN WHEN PLAYING COMPUTER GAMES?

During the last decade various advocates for e-learning have glanced at the field of computer games in order to find some exploitable educational potential of this new media. Elements like immersion, interactivity and fidelity have been seen as components of interactive media (especially computer games) which makes them more likely, for better or worse, to influence knowledge, beliefs and attitudes of the reader/user, than older media [4, 2]. This has brought along expectations about using computer games within education for pedagogical purposes [16]. Even though numerous technology driven projects have developed different sorts of educational computer games, there is far from any clear, undisputable arguments that education benefits from computer games. On the contrary, attempts to use computer games in education has shown to be a complicated affair surrounded by failures [17]. Might it be that we have misunderstood the gaming activity and how we perceive and learn from games?

In our previous research on children's reasoning and sense-making when playing computer games [14, 15] we have seen that *children developed their own conceptual tools* and utilize a specific *computer game discourse* in order to communicate different game features. For example in one game session were 2 boys played a car building game, different car parts were labelled with self invented concepts. A megaphone that could be attached to the car and used for scaring stubborn goats of the road was for instance called the *goatscare* [15]. The overall analysis suggested that the children primarily focused on the possible relationships between themselves as active agents and different objects in the game environment. This could be done without categorizing images, sounds, texts and animations in accordance to the represented phenomena. What could be *done*, i.e. possible ways of interacting with the game, seemed to be most important for the player. From an educational point of view this has far reaching implications about the possibilities to use games for teaching. In one case we saw two boys trading different resources, like grain and iron, in an educational game that depicted Sweden's history. They managed to get through this part of the game, without reflecting or using "grain" as a concept. Instead they used indexical communication, pointing at the screen and calling grain for "it." Thereby *the game in itself* became the primary object of learning and not the represented domain. These findings fits well with Goffman's [8??] description of how games (non-digital games) become social activities with a specific internal logic. Goffman propounds that the nature of a game activity is to treat the game material in accordance with the rules of the game. What becomes relevant for the players is not the aesthetics of the game, neither the representations but the internal relations between different aspects of the game. He pins down his argument in a distinct way when citing a chess example made by Kurt Riezler

> The queen is not a real queen, nor is she a piece of wood or ivory. She is an entity in game defined by the movements the game allows her. The game is the context within which the queen is what she is. This context is not the context of the real world or of

ordinary life. The game is a little cosmos of its own. [8]

In this chapter we try to theoretically underpin our previous findings by testing the possibility to use the *ecological approach to perception*, as it was formulated by James and Eleanor Gibson [7] for approaching the question of how *computer* games are perceived and what is learnt in the process of playing computer games. If children, as our previous research indicate, primarily focus on the functional value of game features (i.e. its local meaning in the game structure) then this finding seems to be very adaptable to the ecological perspective on perception and learning. The purpose of this chapter is to test if ecological psychology is a fruitful theory for understanding digital gaming and thereby outline the first sketch to what could become a more elaborated theory of computer gaming.

What is the ecological approach?
Before we can adapt the ecological theory to perception and learning on the domain of computer gaming some of the basic features of this theory need to be clarified. The most fundamental assumption we make, following Gibson and Pick [5], is that learning and perception when playing games is a process where the player *differentiates* and make distinctions in his/her perceptual field (the information in the surrounding environment) and not a process of *enriching* the things they see on the screen (with previous experiences, i.e. *make* meaning by utilizing both internal and external resources). This means that our approach differs from the more common views about how players perceive and make meaning during game play. A common view about gaming holds that the game experience is based on immersion and that the player identifies herself with the avatar [14], a view which is more or less based on assumptions from cognitive psychology and the idea of mental representations. Besides ecological psychology we have also found it fruitful to incorporate the concept *Professional Vision* [9] in our approach. This concept gives us a way to understand the nature of the competence that a skilled player develops.

Enviroment and Affordances
Fundamental in Gibson and Gibson's theory is the distinction between the physical world and the environment. The physical world contains everything from atoms to galaxies, phenomena which can not be grasped by any animals' perceptual system. For Gibson [6] an environment consists of the living conditions for certain spices. An animal/human presupposes an environment, but at the same time an environment presupposes an animal/human, they are an indivisible pair.

No animal could exist without an environment surrounding it. Equally, although not so obvious, an environment implies an animal (or at least an organism) to be surrounded. This means that the surface of the earth, millions of years before life developed on it, was not an environment properly speaking. The earth was a physical reality, a part of the universe, and the subject matter of geology. It was a potential environment, prerequisite to the evolution of life on this planet. We might agree to call it a world, but it was not an environment [6].

The environment affords certain things for the animal/human. Offers which are relative the animal, water affords breathing for a fish but not for a human, a chair affords sitting for a human but not for fish etc. Gibson found the concept *affordance* which refers to the possibilities and limitations of the environment for a certain animal.

The affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or ill. The verb to afford is found in the dictionary, but the noun affordance is not. I have made it up. I mean by it something that refers to both the environment and the animal in a way that no existing term does. It implies the complementarity of the animal and the environment [6].

Perception
According to Gibson, an animal's perceptual system is in contact with ecological information in the surrounding light. Light that is structured in certain ways depending on the point of observation for the animal and the arrangements of the surfaces in the environment which reflects the light. A human or animal are thus surrounded by what Gibson calls an *ambient optic array* [6] i.e. the perceptual field for a certain individual. It is by making *differentiations* [5] in the *ambient optic array* that we pick some of the available information that tells us what the world around us, our environment, affords us. The information that the light carries tells us about the properties of objects, events and other animals. It helps us to guide our locomotion and our actions. It is here fundamental that animal and environment is adapted to each other.

Perception and action
To perceive affordances is also a reciprocal process in the sense that perception guides action at the same time as action generates new information to perceive [5]. When we interact with the world we alter its properties and thereby

what it affords us. A soccer player moving on the field has new unique affordances in each situation depending on his (and his teammates') movements, the opposing team's actions and the position of the ball. When the soccer player moves he interacts with his environment in such a way that he will be able to see and act upon new affordances.

Learning

Gibson and Pick [5] mean that theories of perceptual learning can be divided into *enrichment theories* and *differentiation theories*. Enrichment theories have that in common that the reception of stimuli is thought to be supplemented by something, for example in cognitive theories where we construct or fit our percepts into schemata of some kind. The ecological approach, on the other hand, is a differentiation theory. In this theory learning is not a matter of construing mental schemata that *enriches* perception. Instead learning is about becoming more and more *fine-tuned* to certain aspects of the environment. Gibson & Pick [5] refer to the first formulations of the theory:

> *The process of learning was one of discrimination rather then of association or making inferences. Perception was thought to change towards closer correspondence with the environment. This kind of perceptual change happens as learning in an adult, as perception becomes skilled and fine-tuned for certain occupations, such as tea tasting or differentiating qualities of snow or performances of ballet dancers*. [5].

Learning is a process of becoming attuned to certain aspects of the environment in such a way that we gain new affordances, new ways to act and interact with the world. We make finer and finer discriminations, for example a mushroom picker first learns to see the difference between edible and unknown kinds which might be poisonous, s/he differentiates what mushroom that affords cooking and eating and what might afford getting poisoned. Then s/he might learn the difference between a *boletus* and an *agaric*, between a *cep* and a *death cap* etcetera. Skilled mushroom pickers can see on terrain features if they are at a propitious spot for a certain kind of mushroom. By differentiating information in the *ambient optic array* they see that a certain part of the wood affords picking chanterelles.

Professional vision

Goodwin [9], working in the field of anthropology, has investigated the social production of *practices for seeing* in a way which can be complementary to the ecological approach. Goodwin means that in specific social settings, like for example the practice of archeologists, participants classify what they see using specific discourses, they highlight certain things and make them stand out so that other things become more peripheral. Thereby;

"participants build and contest *professional vision*, socially organized ways of seeing and understanding events that are answerable to the distinctive interests of a particular social group." [9].

This can be formulated in accordance to the ecological approach. To gain professional vision is then to become *attuned to differentiate the information for a specific set of affordances which is relevant to a certain group in a certain situation*.

Examples of game play; Timesplitters 2

In order to elaborate how the concepts and argumentations above can be applied to computer gaming we will observe some instances of game play from the game *Timesplitters 2* through the ecological perspective. In order to generalize our theoretical points, the examples have been supplemented with some hypothetical reasoning based on other games with a somewhat different design then *Timesplitters 2*. Data should be read more as illustrations of our arguments and *not* be taken as "evidence" for the ecological approach to computer games.

The analytical method employed was Interaction Analysis as it is described by Jordan and Henderson [12]. The aim of Interaction Analysis, according to these writers, is to identify regularities and depict mechanisms in how people interact and conduct their affairs. The data used in this chapter comes from a study where 20 people with different gaming competence were videotaped while playing the game *Timesplitters 2* in pairs. The age of the informants varied from 17 to 57 years and in the population there were 12 men and 8 women. Each pair played for approximately one hour.

The game *Timesplitters 2* is a split-screen multiplayer-focused first-person shooter, meaning that many people can play with or against each other on the same television set.

Table 1:

1. Gunn	Isn't it possible to get in there?	Gunn places her avatar in front of a small window in the door.
	whoops there was actually someone there	A guard appears on the other side.
2. Lina	Yes	Lina's avatar walks to the door and looks through the window
3. Lina	But I can not shoot him?	Lina tries to shoot the guard through the glass but misses and hits the door instead.
		The guard notices the shoots and starts firing at Lina's avatar.

Figure 2: The merged images.

In this chapter we focus on examples which illustrate the strength of an ecological approach to computer games.
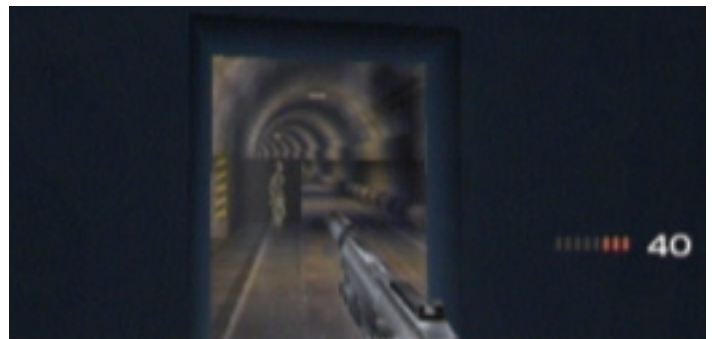
Perception and learning in the practice of playing Timesplitters 2
In the first example Gunn and Lina, who is playing the game for the first time has come to a door in the game world. In this door there is a small window showing a tunnel with some guards (figure 3.)

Figure 3: The window in the door.

Figure1: Timesplitters 2 in a splitt-screen mode.

The data was collected in home environments using 2 stationary cameras, one that filmed the participants and one that caught the screen image. Before the analysis these 2 camera angels were merged into one picture as shown in figure 2.

In the first part of turn 1 Gunn wonders if it is possible to go into the guarded corridor. From an ecological perspective this can be seen as she wonders about the *affordances* of the corridor. Is it possible to get to this part of the game environment? Then a guard shows in their visual field. Lina confirms that she also has seen this (turn 2) and tries to shoot through the glass, she tests the affordances. But since she only hits the door she is also unsure about what the affordances here are and says But I can not shoot him?

This example is probably an example of a very common interaction pattern in the practice of computer gaming. The players try to grasp the properties of the game world. Now the interesting thing in this example is that the players sees a corridor and wonders if it possible to `get in there?` A question that makes sense in accordance to a fundamental property of the game medium; in games you must discriminate between the parts of the game world that has something to do with the game mechanics and the parts of the world which is only 'decorations'. In many games there are doors, windows, mountains in a far distance etc. which are only there to add atmosphere and has nothing to do with the actual game. Consider for instance the image bellow from the game *The two towers*, (figure 4).

Figure 4: A scene from *The two towers*.

In this game event Gandalf is fighting on the walls of Minas Tirith. While the 3 foes on the wall are threatening the avatar the numerous enemies on the ground are just decorations. How many they are has nothing to do with the amount of foes you have to fight. As signs, from a semiotic point of view they are referring to the same thing, the fictitious Uruk-hai creature, from an ecological perspective the ambient optic array of the whole scene contains information for the player that the creatures on the wall and the ones on the ground have completely different affordances. The novice players in example 1 is not yet attuned to the game *Timesplitter 2* to such a degree that they can make clear discriminations to see what parts of the game it is possible to interact with. Therefore they wonder if it is possible to go into the corridor.

Example 2
In this except we see how (inexperienced?) players actively search for the possibilities in a certain game situation.

Niklas has here fallen down a hole in the roof into a building and picked up some mines in the building. Since he is not aware of the 'use' button to open doors and interact in other ways he is stuck in the building. Ulrika, the researcher is here trying to help him by suggesting him to try other buttons.

Table 2:

1. Niklas	There was a thing in here, then I must be able to get out	Niklas avatar has fallen down through a hole in the roof into a building
2. Klas	haha… it is not going well	Klas avatar is inside a stairwell
3. Niklas	If I bump at the door here maybe it helps? Well you can see hehe	Niklas avatar dodges in front of the door
4. ULRIKA	eh, have you used some other button?	
5. Klas	no	
6. Niklas	Well…	
7. Niklas	Because, can he jump?	
8. ULRIKA	He can not jump.	
9. Niklas	Cause I shall go out from.. a hole in the roof, there really or through the door then.	Niklas avatar looks at the hole in the roof
10. Klas	You are completely stuck	
11. Niklas	Yes	

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12. Niklas	Can climb on that one	Niklas avatar looks at a shelf inside the building.

In turn 1 Niklas expresses an assumption that it must be possible to get out of the place otherwise there would not have been an item inside (the mines he picked up before the excerpt). This leads him to test different strategies. In turn 3 he tries to 'bump' at the door by dodging in front of it. He then discusses the possibilities to jump out but hear from Ulrika that avatars can not jump in this game. In turn 9 and 12 he actively scans the game environment by looking around, first up at the hole in the roof and then at shelf. He is trying to make differentiations in his perceptual field and comes up with the idea to climb the shelf; something he finds out is not possible. Had it been a real shelf it would have afforded climbing, if it had been a shelf we saw in a movie we could assume that all the things that can happen with a shelf could also happen on the screen, it could be climbed on, be turned over, be burnt up etc. But in the game it is just the place where the mines you can pick up are. Learning the game then means to distance yourself from the properties of the represented object and learn to see what the local, in-game affordance of something is. A door is therefore not always a door in a game.

Example 3
The next two examples show how players must learn to see the difference between characters.

Table 3:

1. Lina	But that is me right?	They have just started the game. Gunn has picked up a sniper rifle.
2. Gunn	Yes I am behind you.	
3. Lina	But then you must out, come here.	Lina's avatar sees a guard. Gunn walks out from the tunnel.
4. Gunn	Where?	
5. Lina	There, where I am crouching.. Awesome!	Gunn's avatar shoots the guard with the sniper rifle.
6. Gunn	Cool!	More guards approach
7. Lina	Okay forward	Both avatars are fighting
8. Gunn	But what the hell is he shooting at?	
9. Lina	Come on, hurry, hurry they are so many.	The guards are dead, Lina moves forward.
10. Gunn	Wait.. whoops it was you there..	Lina passes Gunn's avatar
11. Lina	That is me	
12. Gunn	Okay	
13. Lina	Come	
14. Gunn	Okay I must just get this away	Gunn's avatar zooms with the snipe rifle
15. Lina	What do we look like?	Gunn's avatar goes to Lina's avatar
16. Gunn	Don't know	Lina's avatar towards Gunn's avatar.
17. Lina	Let me just look at you	
18. Gunn	[inaudiable] Wait look at me again	Lina's avatar spinns so Gunn can not see it.
19. Lina	I am, you are the chap and I am the girl	
20. Gunn	You are the girl, okay	

In this example the players have problems with seeing who is who. Before this example they have previously made the mistake of fighting each other. To avoid further confusion Lina initiates that they should have a more active look (turn

15 – 20). In accordance to an ecological perspective they become *fine-tuned* to *discriminate* among different visual variations between game characters. Something which also happens in example 4 when Nora and Lisbeth see a guard dressed in white for the first time.

Example 4
Table 4:

1. Lisbeth	`There it was!`	Noras avatar is walking in the stairwell and meets a guard dressed in white.
2. Nora	`Shall I kill him?`	
3. Lisbeth	`I don't know, what is he doing?`	The guard has his back against the avatars
4. Lisbeth	`Yes.. kill him quickly`	The guard notices the avatars and turns around with drawn weapons.
5. Lisbeth	`Head, lower when they bend.` `Take his ammo.`	The avatars defeat the guard
6. Lisbeth	`Can you shoot at the crates?`	
7. Lisbeth	`There!  Shoot him!`	A guard dressed in brown shows up.

Up until this moment the players have only encountered guards dressed in grey. Therefore they are not sure if the man in white is a foe and question if they should fight him. They are not sure what the situation affords until the guard draws his gun. In the example Lisbeth also wonders if you can `shoot at the crates`? These crates become the focus of interest for other players as well in example 5 and 6.

Example 5

In the game there are two kinds of crates, exploding and non-exploding ones (see figure 5). The way the players test out the affordances of these crates illustrates a learning process towards developing *professional vision*. In the first example Fredrika simply tests the affordances of the crate.

Table 5:

1. Fredrika	`What is this?`	Fredrika stands in front of a non-exploding crate.
2. Margareta	`Who are you shooting at?`	Fredrika fires at the crate
3. Fredrika	`I was just shooting at the crate, just wanted to see`	
4. Margareta	`On the crate, hehe`	
5. Fredrika	`Yes, I wanted to see what was in the crate`	

Turn 5 shows us that Fredrika is aware of the fact that in-game crates often can be opened if you fire at them and inside the player can find different items. Though, in this particular game this is not possible. Yet Fredrika has some sort of competence, she is attuned to shooting at crates which makes complete sense in a computer game. In the final example we see how two players become even finer attuned to make discriminations in the game environment.

Example 6
Table 6:

1. Shahin	`But what I am shooting.`	The players' avatars are in the stairwell. Saza's avatar shoots on some barrels that explodes and destroys a surveillance camera.
2. ULRIKA	`May I just turn down the sound so I can get what you say.`	Saza's avatar shoots a guard who stands in front of an explodable crate.

3. Shahin	`You do not want to get what we say.`	Shahin's avatar moves forward, Saza's avatar shoots the crate so it explodes.
4. Saza	`It can't be blown up.`	Shahin has walked to another, darker kind of non-exploding crate which he shoots at. Saza's avatar arrives and fires one shoot at the same crate before passing it.

In turn 3 Saza tries shooting at a crate with the result that it explodes. In turn 4 Shahin tries and shoots on a non-exploding crate. When Saza arrives he also tries to shoot and then confirms that `It can't be blown up.` By doing these small game actions, the players learn to discriminate between exploding and non-exploding crates.

Figure 5: Exploding and non-exploding crates.

Again, like in the example with the Uruk-hais, what is represented is similar – but small variations in the ambient optic array contain information provide very different meanings for the players.

Both Timesplitter 2 as well as the game *The two towers* are rather straightforward action games with a strong emphasis on spatial movement and coordination. It is therefore important to point out that our suggested ecological approach to computer games does not separate between those parts of the player's perceptual field that represents a virtual world and those that are a part of the interface. The ecological approach means that all information in the game, (visual as well as no-visual) becomes cues telling the player about affordances in the game environment. The screen shoot bellow, taken from the online role-playing game World of Warcraft might serve as an example. The image contains lots of information, apart from the representation of virtual space there are chat windows, radars, health bars for other players, inventories with the player's resources and actions bars. In order to make sense of this perceptual field the player must learn to make distinctions that make successful interaction possible. A skilled player, with *professional "World of Warcraft" vision* would probably attend to the red color around on one character and the portrait with the golden dragon and the number 19. This would tell the player that the character was a level 19 elite enemy, which in this situation with a group of 5 collaborating players is not a serious threat, i. e. it has the affordance of being defeated and thereby providing the player with a moderate reward. Had the level of the enemy been 45 instead, still looking exactly the same, this difference (19, 45) would tell the player that the character afforded loosing the fight and not be able to get further into the virtual environment.

The ecological approach to computer games also applies to abstract games (i.e. games that do not clearly represent something beyond itself). In the classical puzzle game *Tetris,* professional vision would be the ability to see appropriate spots where to place the falling puzzle pieces, i.e. seeing the affordances of the unique game situation. It is also important to point out that the perceptual field when playing computer games does not only contain visual information. All sense modalities are at work when we pick up information about what the situation at hand affords us.

CONCLUSIONS

By framing computer gaming with an ecological approach to perception and learning we end up with the following statements about gaming:

1.) The basic perceptual act for a computer gamer is to pick up affordances in the game environment. She or he sees possibilities for how to interact with the game.

2.) This is a process of discrimination where the gamer learns to make more and more complex distinctions in her/his perceptual field. The gamers' perception is shaped through the gaming practice so she/he develops a form of *professional vision*.

3.) Even though the perceptual field for someone in front of a computer game can seem to have similarities with the sensory experiences of other screen based media or the direct perception of "real" objects and events, the gamer becomes attentive to the differences in the perceptual field which shows her/him the game specific affordances in the situation at hand.

4.) Therefore the gamer has a perceptual field (ambient optic array) which is "unique" i.e. it differs from what it would have been to see the "real" objects and the "real" events which the games depict (since they show a completely different set of affordances). It also differs from the perception of depictions in non-interactive media like movies.

5.) To develop professional vision as a gamer is therefore a process where the represented phenomena in the games are very likely to become more and more peripheral for the gamer as her/his skill in the game increases.

Since enrichment theories like for instance (social) semiotics and cognitive psychology, views images as isolated elements and not as part of a perceptual field, different element in the picture are seen as building blocks for creating meaning. The underlying metaphor for such a theory is then construction, where our previous experience enriches the perception of the sign. For example Kress' [13] theoretical framework about literacy and multimodality is based on the idea that both producing and perceiving an image (or other displays created by mankind) is a process of *sign making;*

> *The sign that comes to the receiver in communication is taken by her or him as an object for interpretation; in the act of interpretation, a new sign is formed ./.../ The receiver sees, hears or feels only the form, the signifiers, and from their 'shape' and on the basis of her knowledge of the social place where the sign/message has come from, and on the basis of her or his interest, will produce a signified and hence a sign as her or his meaning from it.* [13].

No matter if the construction metaphor is supported by some sort of theory or not, it lead us to think about game perception as an act of identifying what different elements represent, what they signify, and then put them together to meaningful strips of gaming. To perceive and learn within a gaming situation here becomes a process where we 'see'

beyond the screen (and therefore might handle the represented content in accordance to our previous experiences of what is represented in the game). Meaning making when playing a game is therefore a process where we supplement our percepts with previous experience. We can call this supplemented information schemata, mental representations, semiotic resources or simply knowledge, it will not matter, the idea is structurally the same.

Once we have decided that game perception is a matter of adding experience to our percepts the question arises; what experiences do we use for cooping with the things we see on the screen? The most evident answer to this from a semiotic point of view is that we make sense of games in accordance to our knowledge or lack of knowledge about the things that the games represent. When we play a first-person shooter a semiotic view holds that we use our experiences of life and death, violence and weapons. When we play the city simulation SimCity, we likewise give the game meaning by using the knowledge we have about urbanization, urban planning and infrastructures for communication etcetera.

An entailment of this view is that gaming is a process where the gamers' knowledge or lack of knowledge of the represented phenomenon becomes focal in a process of reading/understanding/interpreting the game. In this paper we suggest in accordance to an ecological approach that the most basic process when perceiving games is not to identify signs but to see the affordances in the gaming situation. This is not done by *construing* meaning i.e. adding elements/resources to each other, but a process of *differentiation*. Images on the screen in a computer game might have structural similarities with the things they depict but it is not the similarities but the differences that the gamer becomes attuned to; the differences that contain information for the affordances in the situation, variations in the optic array saying that this virtual crate affords exploding and this one does not. This is something very different from seeing a real crate which has a completely different set of affordances. To become a skilled player is therefore a process where the gamer develops a more and more fine-tuned perception and in one sense is more and more distanced from seeing the screen as a depiction of something else.

The fact that we can interact with a screen image in different ways seems to be hard to grasp with existing views on media. Much work remains before we intellectually can understand computer games. Here the ecological approach might be a point of departure.

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