I solved notpr0n!
Learning in an online puzzle game

Abstract
In this paper a so called *online puzzle game* called *notpron* is described and analyzed, with the purpose to find out what kind of learning capability it has, and how the learning occurs in its gaming and social context. The game is analyzed with the help of James Paul Gee's 36 learning principles formulated in his book *What video games have to teach us about learning and literacy*. The research methods and materials of the study consist of an analysis of the game itself and of the connected forum, email interviews with the creator of the game David Münnich, a close reading of David Münnich's "pdf-book" about the game, and participatory observations while playing the game and being active in the connected forum between February 2005 and May 2006. The analysis shows that notpron *can* work as a learning environment, that improves the player's "computer competence" and "digital literacy". However, due to its high level of difficulty, only a very small number of people manage to finish the game.

Keywords
Online puzzle game, Gaming communities, Digital game-based learning, Situated learning, Learning principles, Computer competence, Digital literacy

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Introduction

This paper has two purposes. The first purpose is to draw attention to an interesting game genre called online puzzle games (or online riddle games). I want to do this by describing and analyzing a famous game in this genre, called *notpron*. The second purpose is to discuss whether this game (and similar games) could be regarded as learning tools.

Research on digital game-based learning (DGBL) basically involves learning through two kinds of games; games that are designed to be educational tools (formerly known as edutainment games), but also learning that takes place in commercial of-the-shelf (COTS) games (Eck, 2006). Notpron doesn't really fit into any of these two game categories. It is not a COTS game, since it was created by an amateur without commercial interest, and it wasn't designed to be a learning tool, albeit it has been praised by its users for making them learn a lot.

Theories about digital game-based learning (e.g. behaviorism, cognitivism, constructionism, situated and socio-cultural approach) focus on *how* we learn (Egenfeldt-Nilsen, 2006; Kirriemuir & McFarlane, 2006), but Prensky (2001) points out that we also have to take into consideration *what* is learned. My analysis of notpron is based on a socio-cultural approach and I look upon notpron as a situated learning environment for "learning by doing". This approach is extensively introduced and explained in James Paul Gee's (2003) book "*What Video Games have to teach us about learning and literacy*". I have used Gee's 36 general Learning Principles as a "check list" in my attempt to analyze notpron as a learning environment. In accordance with Prensky's view I have also considered the specific characteristics of the learnt subject(s) which, at least partly, could be described as "computer competence" or "digital literacy".

The data about notpron is collected through the following sources: analysis of the game itself and of the connected forum, a close reading of the creator's, David Münnich's, "pdf-book" about the game, email interviews with David Münnich, and participatory observations while playing the game and being active in the connected forum between February 2005 and May 2007.

Gee's 36 Learning Principles

The objective of Gee's book is to study "the theory of human learning built into good video games" (Gee, 2003, p. 6) Thus, the 36 Learning Principles is a way to describe what it is exactly that makes a digital game a good learning environment. One of Gee's essential points is that we don't just generally learn; there is always *someone* learning *something* in a specific *context.* Gee means that *situated learning* is essential for profound knowledge and skills in what he calls a "semiotic domain".

A digital game is a semiotic domain in which the player is embodied when playing it, and if the game has a good design, it supports *active and critical learning* about that semiotic domain. Active learning means that we *experience* the world, by engaging, acting and producing meaning in a semiotic domain. It also involves affiliation with the "affinity group" connected to the semiotic domain, and it means that we get knowledge and skills that prepare us for future learning and problem-solving in the domain as well as in related domains. Gee's Learning Principles give useful guidelines on how to determine whether a game is a good learning environment or not, so I have used these principles to test notpron's qualities in that respect.

Notpron – an online puzzle game

Most computer and video games are made by big companies, with a huge production apparatus and costly marketing resources. However, an interesting aspect of the digital revolution, is the possibility it gives to ordinary people to create, and, via Internet, distribute games to a large audience. Notpron is an example of this amateur game design, which is part of a more broad non-professional creative and user participation movement in digital media, including open source culture, machinima, blogs, wikis etc (Bardzell, 2007; Giger, 2006).

In comparison with most COTS games, notpron is very simple in its appearance. It has no game world, no 3D graphics, no animations and no action scenes. The game is based entirely on simple web pages with a picture, a background sound, and occasionally some text. The player's only objective is to get from one page to the next using hints and clues hidden on the previous page. The only measure of the players achievements is whether (s)he reaches the next web page or not – there is no score system or other

measuring parameters. Compared to most other digital games there is also a remarkable difference in the way the player interacts with the game. The way to get to the next level (i.e. web page) in notpron is to find a specific word that should be entered in the URL address field of the browser (or in some cases: find two words to use in a login window). The way to find these word(s) always vary from level to level, but the typical way is that you first have to find hidden hints and clues on how to proceed, and then, solving puzzles by going through more or less complicated procedures, reveal the word(s) that gets you to the next level. Compared to other digital games, the "gameplay" of notpron is very slow, and involves a lot of thinking instead of computer interaction. Despite this modest surface and simple game concept, some people prefer playing notpron before playing games like Counterstrike and World of Warcraft.

On its start page (http://www.deathball.net/notpron/) notpron is called a "riddle", but "online puzzle game" is a more widespread term for this kind of games.[1] In this paper I will use the abbreviation OPG:s when referring to the notpron genre. The puzzles in OPG:s often have similarities with more traditional puzzles like brain teasers, logic riddles, spot the differences-pictures, crosswords etc. and one can also see a kinship with game genres like adventure games and alternate reality games (ARG:s). Notpron could be described as a chain of puzzles, where the reward for solving one puzzle is gaining access to the next one. Adventure games might be characterized in the same way, but they also give rewards in form of an evolving story and access to new places in the game world, which is not the case in notpron, since it has neither story nor game world. Another important difference compared to adventure games is that the information and tools needed to solve the puzzles in adventure games typically is hidden *inside* the game, while in OPG:s (as in ARG:s) one also have to seek information outside the game itself, mostly on the Internet.

In addition to traditional puzzle types, like logic or mathematical puzzles and word riddles, the OPG:s also uses the digital medium to create new kinds of puzzles that wasn't possible in older media. Sometimes the answer can be found in the picture or in the background sound: maybe you need to lighten up or magnify the picture to make a word appear, or maybe you need to play the background sound backwards or faster to hear something that gives you a hint. To do these things you need the tools and the skills to manipulate digital pictures and sounds in software like Photoshop and Audacity. The source code (html code) of the web page could also hide a clue to the solution. To find these clues you have to know how to access the source code and you need to understand what is normal html code and what is not. Often you also need to "google" to solve a level. The hint could for instance be a date and you need to find out what happened that day (Maybe it's the day Elvis Presley died and the word you are supposed to put in the address field is "elvis.html").

OPG is a quite new genre; it has had an explosive growth since 2004. The Nordinho Forum (http://www.nordinho.net/), which according to itself "provides daily links to the best games, movies, pictures, quizzes, and fun on the web" has an OPG sub-forum, which in March 2007 contains threads about more than 400 different online puzzles. General forums like Nordinho play an important role in the amateur culture mentioned above, as they work as a "digital grapevine" in spreading the games and helping the players with hints and walkthroughs. Most online puzzle games also have their own forum closely connected to the game, used by the game creator to explain the rules of the game, announce new levels in the game etc. In these "connected forums", as I will call them, the players (and sometimes the game creator) also can discuss the game, give each other clues and hints for the solutions of the puzzles and so on. One can actually argue that these connected forums could be seen as a part of the game itself.

Notpron is one of the earliest and most famous OPG:s, and it has generated a lot of very similar "clones", wherefore one could say it's a sub-genre of its own. It was started in July 2004 by a then 22 year old German, David Münnich. Notpron was created and published step by step, which is common for

[1] Online puzzle game is actually not a very adequate term for these "change-the url-to-get-to-the-next-web-page" kind of games. The term "Online puzzles" is also used for other types of games, like point-and-click puzzle games made in flash, e.g. Michael Claque's (2004) *aooa* (http://www.aooa.co.uk/), Toshimitsu Takagi's (2004) *Crimson Room* (http://www.fasco-csc.com/works/crimson/crimson_e.php) and *Samorost* (2005) (http://www.amanitadesign.com/)

OPG:s. When Münnich published the game in July 2004 there were only five levels (web page 001)[2], but during exactly one year he created and published new levels continuously (about two or three levels each week) until he stopped in July 2005. During this time Münnich also invited the players to send him ideas about new levels, and in the credit page of the game he lists 32 persons who helped him with one or more levels (web page 002). The players' creativity can also be noticed by the fact that many of them have made OPG:s of their own (web page 003). In May 2006 Münnich suddenly made two new levels because he had "a sudden idea" (post by DavidM 04-05-2006 13:23, web page 004), but that was all. Since then the whole game consists of 139 levels, and David Münnich has made it clear that there will be no more.

There is no explicit connection between the different levels in notpron, no main thread in the form of a story or some other kind of continuation. Sometimes the solution to one level assumes knowledge about an earlier level, but mostly the only connection between the 139 levels is that they are named in a succeeding order[3] and that all pages have the same layout, with a photo on black background and a background sound attached to each web page.

Soon after creating notpron David Münnich opened a forum thread about notpron in a game community where he already was a member (email 005). A couple of months later he started an entirely new forum, where he opened threads for each one of the first levels. In these threads he gave additional hints for the solutions to the levels. Soon players started to post in the threads, asking each other for hints, and also started new threads by themselves. The forum quickly became a very active community; in March 2007 the forum consists of 252 threads and almost 90.000 posts. However, posts are constantly erased by the moderators. According to Münnich the total number of posts since the opening of the forum is actually about half a million (email 005). In this community of so called "notproners" there is an amazingly familiar and personal atmosphere, which might be unexpected since its primary purpose is to give hints on how to solve the puzzles. One thread for instance is intended for picture posts, and there you can find photos of most of the notproners (web page 006). Here you can also see that some of the players became friends through the forum and have met in real life. The communication between the notproners also takes place in personal messages (pm:s) that they can send to each other in the forum, and they can also chat about the game and help each other with the puzzles in an IRC channel: quakenet #notpron. (IRC stands for Internet Relay Chat).

The following section contains a detailed log of what happened when I solved one level in notpron. The purpose is to give a concrete comprehension of what “playing” notpron is like.

Log of a “gameplay session”, solving level 21 in notpron, March 20th 2005

I’ve been working with level 20 for many hours now, and at last I think I may have the solution that will take me to the next level in the game. I have two words, so I know I’m supposed to put them in a login window that appears when I click a hotspot on the picture of this level’s web page. I type the first word in the username field and the other word in the password field, and then I hit the ENTER key.
My heart is beating faster... are they the right words? Will they take me to the next level or not?

Yes! The login window disappears and a new web page starts to download. The first thing I perceive is that the new page has a black background. Then I know I have succeeded! The 404 pages[4]

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[2] Since I am referring to a number of web pages, online forum threads and emails in this paper and since web pages continuously changes and emails can be lost, I have saved all the cited web pages and emails as PDF-documents and given them a cache number, which I will use as reference in the text, e.g. “(web page 001)” means “web page with cache number 001” and “(email 003)” means “email with cache number 003. More information about these digital documents can be found in the References.

[3] First there is 82 levels numbered in order, then there is 45 more going from 0 to minus 44 and finally there is 12 levels named with Greek letters, from alpha to mu.

[4] In the levels where the solutions is just one word that you should put in the url, you get a “404” (a “File not found” error message) if your word is not the right one.

always have a white background, and so has the Easter Egg pages that you sometimes find, when your answer is incorrect. I feel satisfied and proud for being so clever. Now on to the next task!

The background sound of the new level is the usual one. I hear those long bass tones played on a piano, together with the spooky hauling sound, that is so familiar to me by now. Since this is the same sound as in 95% of the levels, I'm quite sure it doesn't hide a clue, so I concentrate my attention on the visual part of the web page instead.

The picture of this new level (see Figure 1) is a dark photo showing some objects on a table, including a scull. The title of the web page is "the fake trapped him", which might be understood as referring to the scull. However, that interpretation leads me nowhere, so I let it go. I realize that the important part of the picture is probably not the objects in the photo, but some bright words and signs typed on top of the picture. If they were not important, why would they be there?

In the bottom left corner of the picture there is the sign "α". Underneath it is a white square. Above the "α" sign, at some distance, one can se this combination of signs: "Ω1", and at the lower right part of the picture: "Ω2". All these characters are in a white typeface.

Figure 1: Level 21 picture "white.jpg"

Furthermore, in the right half of the picture, there is a list with the following nine words written in bright colors:
"blue" (written in red letters)
"green" (written in yellow letters)
"orange" (written in black letters)
"red" (written in light brown letters)
"lilac" (written in orange letters)
"yellow" (written in pink letters)
"pink" (written in blue letters)
"light_blue" (written in green letters)
"black" (written in grey letters)

I look at all this for a while and try to make some sense out of it, but the only thing I can tell is that the white signs look like the Greek letters alpha (α) and omega (Ω) and that the color names printed in non-corresponding colors reminds me of the so called Stroop effect, which refers to the fact that people hesitate and make mistakes if they have to name a color they see appearing in a word that signify another color.

So, what else can I do? Sometimes there are clues hidden in the **source code** of the page (See Figure 2), so I open it by right-clicking on the web page choosing "View source code". At this point in the game I have become familiar with the normal html code, so I recognize the most common html tags and can discern things that are unusual in some way or another. In the source code of this page I can see that the picture's file name is "white.jpg" and there is also a comment that is not part of the "operating " html code of the page: <!--First to beat it: [zeend_22] stupid maze :P-->

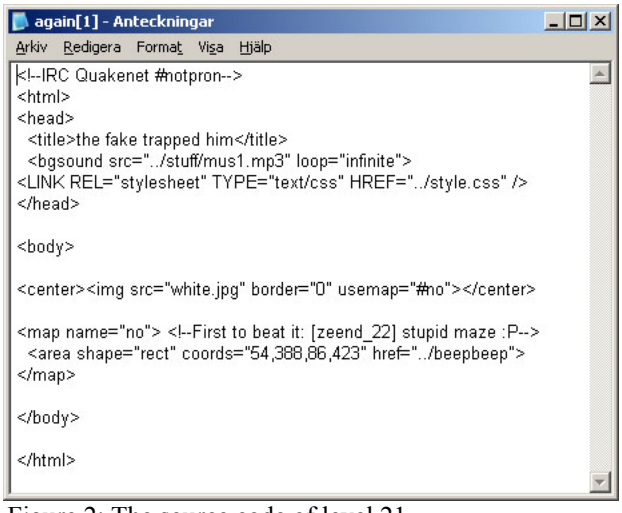

Figure 2: The source code of level 21

"First to beat it" must refer to the first player who solved the level, which apparently was someone called "zeend_22". But what does "stupid maze" mean?

In the source code I also notice that there must be a clickable hotspot somewhere in the picture, since I notice a so called area tag there that is used to make hotspots in html. The hotspot is located at the "α" sign in the picture, which I detect by hovering the mouse over it and notice that the cursor turns into a pointing hand. When I click the hotspot, a login window appears, on which I read the hint "the a and the z".

The existence of a login window means that the solution to this level consists of two words, that should be put in the user name and the password fields of the login window.

So, let's summarize now. What clues have I got?

1.	The name of the picture (white.jpg)
2.	Nine different color names written in other colors
3.	The title of the page: "the fake trapped him"
4.	The "stupid maze" comment in the source code
5.	The signs "α", "Ω1" and "Ω2" in the picture
6.	"the a and the z" hint in the login window

Figure 3: Clues in level 21

I contemplate on these clues for a while, and suddenly I see a connection between clue number 1 and 2. The name of the picture is the name of a color, and there are nine other color names written in the picture! Since there is one picture file with a color name, maybe there are more? I decide to test this hypothesis! But if there are more pictures – where can I find them?

In the source code I can figure out that the "white.jpg" file is located on the web server in the same folder as the html file. I know that, because in the image tag there is no path that specifies a folder where the picture is located (the image tag only says: <img src="white.jpg">) This means that if I want to download the "white.jpg" picture, all I have to do is to replace the name of the html file in the url with the name of the picture.

I do that and hit the ENTER key, and now there's just the picture in the web browser window, no web page with background color and background sound etc. I right-click on the picture, choose "Save as" and save it to my hard drive. I know it's a good idea to save the pictures of every level, because they often hide clues that you can find if you open them in a graphic application and examine them carefully.

But now I'm eager to see if there are more pictures with color names hidden in the same folder as the white.jpg picture! I decide to try with the first color that is named on the picture, so I write "blue.jpg" instead of "white.jpg" in the url, and hit the ENTER key. It's such a pleasure to see that the result is a new picture appearing on screen. This is certainly a breakthrough! My hypothesis is confirmed and I'm a step closer to the solution of the level.

I look at this new picture. (See Figure 4) It has a white background on which there are 14 long narrow blue rectangles placed vertically or horizontally in the picture. The picture has a black border around it, and there is a black square in the bottom left corner. That's all. With clue number 3 in mind, the rectangles remind me of an incomplete maze ... But there would have to be more rectangles to make it a real maze.

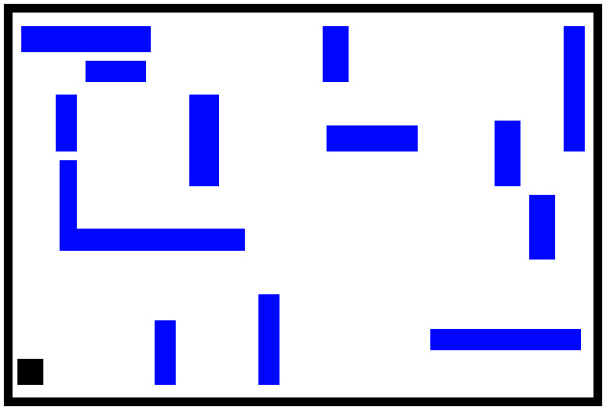

Figure 4: Picture "blue.jpg"

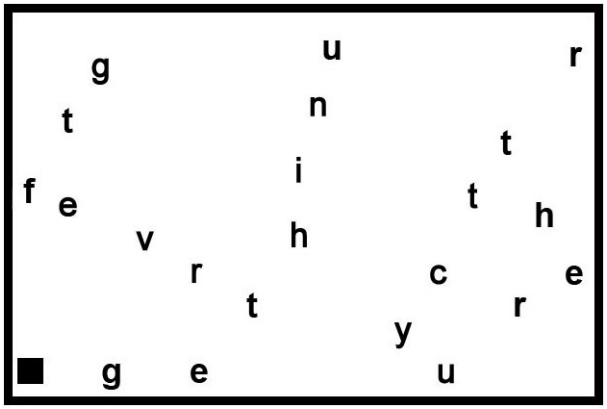

Figure 5: Picture "black.jpg"

So maybe there are more pictures? Yes there is! I manage to download and save pictures with all the color names listed in the picture (i.e. green.jpg, orange.jpg, red.jpg, lilac.jpg, yellow.jpg, pink.jpg, light_blue.jpg and black.jpg). And, like blue.jpg, all the pictures – except black.jpg – consist of maze-like patterns of long narrow rectangles in the same color as the picture's name! (I will call these pictures "the maze-pictures".) The black.jpg picture is different. (See Figure 5) It consists of 22 letters scattered around. All the pictures – including black.jpg – has a white background, with a black border around them and also a black square in the bottom left corner of the picture.

So what should I do now? Maybe I could combine the "maze-pictures" and get a complete maze that way? But how to do that? Since Photoshop is the graphic editing application I'm most familiar with, I solve it like this:

1. I open one of the maze-pictures in Photoshop to use as my background for the combined picture
2. I open another one of the maze-pictures
3. I select the white background of this picture with the Magic Wand Tool
4. I inverse the selection so that everything except the background gets selected (that is the rectangles, the border and the black square in the bottom left corner)
5. I copy the selected items (with the CTRL + C keys)
6. With the CTRL + V keys, I paste the selection into the picture I opened first, but in a different layer. (Layers in Photoshop allow you to separate different graphical elements in the picture, which makes it easy to manipulate them separately without interference with the rest of the picture. In this case it made it easy for me to adjust the position of each pasted set of rectangles.)
7. I move the new layer to the correct position by placing the black square in the bottom left corner exactly on top of the other picture's black squares.
8. Then I repeat 2 to 7 with all the maze-pictures

When I'm done I look at the result – is it a maze now? No! It's just a mess! There are too many rectangles. They intersect too much, so there's almost no space between them. Maybe I shouldn't have used all the maze pictures? But if I'm supposed to exclude some of them, how am I supposed to know which ones to use and which ones to leave out?

In Photoshop you can make layers invisible by clicking an eye-symbol next to each layer in the layers palette, so I randomly click on these eye symbols to make some layers visible and some invisible. The picture looks more like a maze when some layers are invisible, but I still don't know exactly what layers (and how many) I'm supposed to leave visible. I feel dejected. I thought it was going so well and now I'm totally lost...

In notpron you never have to *guess* what steps you need to take to solve a level. There is always a hint or a clue somewhere that tells you what to do – often in a cryptic way, of course. In the connected forum you can also get some additional hints if the ones you found on the level page aren't enough. So I go to the forum and open the level 21 thread. (web page 014) There are two hints there (posted by the moderator "junimond"):

"What's the filename of the graphic?" (Post by *junimond* 10-03-2005 16:12, web page 014)
"Keep in mind that colours can lie" Don't play with liars! (Post by *junimond* 10-03-2005 16:13, web page 014)

The first one refers to what I have already found. That the level picture's name is "white.jpg" which gave me the idea to look for pictures with other color names. But what about the other hint? What does it mean that colors can "lie"? I look at the color words on the level picture. In a way they *all* "lie", because the color of their letters are not corresponding to the color they represent! I decide to analyze this in detail by making a table that shows the relationship between color names and colors (See Figure 6).

color / word	blue	green	orange	red	lilac	yellow	pink	light blue	black	other
blue				X						
green						X				
orange									X	
red										**brown**
lilac			X							
yellow							X			
pink	X									
light blue		X								
black										**grey**

Figure 6: Colors of the words in the level 21 picture. In the rows the "X" indicates what color a specific word has, e.g. the word "blue" has a red color.

Creating this table makes me notice that there are actually 11 different colors occurring in the list on the level picture, i.e. they occur as a word for a color name and/or as a color. Seven colors occur both as colors and as color names. Lilac and light blue occur only as color names and brown and grey only as colors. Since there were no pictures named "brown.jpg" or "grey.jpg", the two maze pictures that differs from the rest is lilac.jpg and light_blue.jpg, because they have color names that don't appear as colors in the list of color names on the level picture.

So how can we now interpret the liar hint? Maybe we can regard the list as an attempt to name the colors that are present in the same list. In that case there are some errors in the list:

1. Two color names (lilac and light blue) "lies" since there are no such colors present
2. Two color names (brown and grey) are missing – but we can't blame any single color name for that

So, if lilac and light blue are the "liars", I should probably exclude the lilac.jpg and the light_blue.jpg picture from the maze. Now I also realize that the third clue I found in the title of the web page ("The fake trapped him") probably refers to these "fake" pictures that certainly trapped me in my attempt to create a maze!

I go back to Photoshop and make the layers with the lilac and the light blue rectangles invisible, and now the picture looks like a maze! But how do I get two words out of this maze? I realize that there are clues I haven't used yet. The remaining clues are the signs "α", "Ω1" and "Ω2" in the level picture and the "a and the z" hint in the login window and the picture. There is also a picture I haven't used, namely black.jpg, with all the letters.

The purpose of the letters in picture black.jpg must be to give me the two words I need for the solution. But as they are scattered around randomly in the picture there is no obvious way to make them form two words. Maybe if I paste them into the maze picture and read them as I make my way through the maze? Yes, that must be the way to do it, since there also is a black square in the picture with the letters like in all the maze pictures.

I open the black.jpg picture in Photoshop and select the white background, invert the selection so all the letters, the border and the black square is selected and paste it on top of all the maze layers. When I have adjusted the letter layer, the letters land neatly upon the rectangles that I thought were the "walls" of the maze. Maybe I'm not supposed to travel through the maze *between* these "walls" but *on* them instead? Yes, it must be so; otherwise I can't form words from the letters since I don't pass through them. But where in the maze should I start and how am I going to get *two* words?

I contemplate on the two remaining clues... Alpha ("α") is the first letter in the Greek alphabet and omega ("Ω") is the last letter – I suppose that's what the hint "the a and the z" wants to point out. The expression "from a to z" gives me the idea that the purpose of the Greek letters is to direct me through the maze in some way, and suddenly it strikes me: If I paste the Greek letters into the maze and then go first from "α" to "Ω1" and then from "α" to "Ω2", I will pass two sequences of letters and they will hopefully form the two words I'm looking for!

I do that, and my hypothesis is verified, since I get the two words "getting" (from the letters I pass from "α" to "Ω1") and "further" (from the letters I pass from "α" to "Ω2"). I feel jittery when I go back to the level 21 web page and click the hotspot on the alpha letter there. The login window appears and I type "getting" in the username field and "further" in the password field. Clicking the OK-button gets me to the next level in the game and I'm filled with happiness!

Analysis of the log

Let's summarize: What steps are necessary to take in order to solve this level (without guessing or cheating) and what knowledge and skills are required to be able to take these steps?

Required knowledge and skills to be able to *find* the six clues (See Figure X above)

- be observant and focused and notice everything that could be a clue (useful for all clues)
- know how to find the file name of a web page picture (clue 1)
- know where to find the title of a web page (clue 3)
- know how to open the source code (html code) of a web page (clue 4)
- know how to distinguish a so called comment in the source code (clue 4)
- know how to find and click a hotspot in a web page picture (clue 6)

Knowledge and skills that helps to *interpret* the clues

- have the ability to see the consequences of combining two or more clues (e.g. clue 1 and 2),
- possess analyzing skill, association skill, imagination and creativity
- possess situated skills, familiarity with the semiotic domain, its design principles, affinity group etc.

Knowledge and skills required to *find and download the additional pictures*

- have the ability to form a hypothesis about the existence of the hidden pictures and find a way to test this hypothesis
- be able to distinguish different elements in the source code, like the path to where an image file is located (to find the nine additional pictures)
- know how to download and save a specific file located on a web server, even if the file isn't present on a web page

Knowledge and skills required to *exclude the right pictures*

- knowledge about the connected forum and how to find the right thread in it
- be able to interpret the "lying colors" hint, and use it to identify the pictures that should be excluded

Knowledge and skills required to *create the maze picture*

- know a way to combine elements from different digital pictures in a graphic editing application[5]

Knowledge and skills required to *find the two words in the maze*

- know that "α" (alpha) is the first letter in the Greek alphabet and that (omega) is the last.
- be able to interpret "the a and the z" clue (meaning go from "α" to "Ω" in the maze)
- be able to find the way through the maze from "α" to "Ω1" and from "α" to "Ω2" and writing down all the letters passed on the way

We can observe that the knowledge and skills you need to be able to solve the puzzles in notpron are of many different kinds – some very hands-on know-how (mostly different kinds of computer competence), some knowledge of facts (e.g. about the Greek alphabet), some creative talents (imagination, association etc.) and some more "rational thinking" skills (analytical, logic etc.). The levels are different in this aspect. Most levels require rational thinking and a creative mind, especially for interpreting the given clues, but on some levels knowledge of facts is more essential than in others (in these levels googling skill is usually required). In other levels (like level 21) you need to know how to manipulate digital pictures or sounds in an editing application etc. This explains how notpron manage to vary the challenges throughout the 139 levels. Another type of variation is, of course, the gradually increasing degree of difficulty in the game.

Is notpron a good learning environment?

We now know that people who managed to solve notpron had a lot of different knowledge and skills when they did it (if they didn't cheat of course). But how and when did they obtain this knowledge and skills? Maybe they had all the knowledge and skills they needed before they even started solving notpron? Or did they get this knowledge and these skills as a result of playing the game? If the latter is the case, I think we can claim that notpron *can* serve as a learning tool. (Whether notpron is a *good* learning tool *for all people* is a question we will discuss later in this paper.)

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[5] When I solved this level, I used Photoshop, which means I had to select the needed elements and paste them into the maze picture. I had to put them in different layers to be able to adjust them in relation to each other. There is however a way to do it, that is much easier! If you use MS Paint instead of Photoshop, all you have to do is to open one of the pictures in MS Paint and then click the Transparent button before you chose the "Paste from" command in the menu. Then you can chose one picture file at the time to paste into the first picture, and the background of all pasted pictures will become transparent and all pictures will automatically end up in the right position!

There are actually several testimonies in the forum that indicate that notproners sense they have learnt a lot by playing the game. Here are a few examples:

> "it's hard to make a n00b learn graphic editing, audio editing and googling, but you [i.e. David Münnich] did it"[6] (Post by *i* [sic!] 2006-06-12, 08:16, web page 007)

> "In my very personal opinion, I have learnt a LOT, you cant say you know a lot of computers, internet, photoshop, browsers, sources, pictures, layers, music, cords, history, etc etc until you play this god damn riddle (god damn in the best way ever)" (Post by *Mexican_Minded* 2005-08-08, 18:47, web page 008)

> "Because of notpr0n, I could make my own [web]site" (Post by *BiGGBLiZZ* 2005-08-02, 14:05, web page 007)

> "This game tests your computer skills [---]and also teaches you new ones" (Post by *nighthawk263k,* 2005-09-29, 04:27, web page 008)

The last quote makes an important distinction between *testing* and *teaching* knowledge and skills. Is notpron a good learning environment for the skills needed to solve its puzzles? To answer that question I have used some of Gee's 36 Learning Principles as a measuring instrument, to evaluate if notpron implements those principles or not.

Active and critical learning in notpron

Gee's first Learning Principle is about the importance of *active and critical learning*. I will first discuss *active learning*, which Gee explains this way:

> When we learn a new semiotic domain in a more active way, not as passive content, three things are at stake:
>
> 1. We learn how to experience (see, feel, and operate on) the world in new ways.
> 2. Since semiotic domains usually are shared by groups of people who carry them on as distinctive social practices, we gain the potential to join this social group, to become affiliated with such kinds of people (even though we may never see all of them, or any of them, face to face).
> 3. We gain resources that prepare us for future learning and problem solving in the domain and, perhaps, more important, in related domains. (Gee, 2003, p. 23)

Notpron, at least partly, matches these three criteria. Solving the puzzles in the game undoubtedly forces us to see, feel and operate on the (digital) world in new ways. The notpron community, acting in the connected forum and in the IRQ channel, is a distinct social group sharing the semiotic domain of notpron, which all serious notpron-solvers can become affiliated with. Since the level of difficulty increases as you advance in the game, and since many of the puzzles in later levels are based on things you learned in earlier levels, you certainly gain resources for future learning and problem solving in the domain. But what about related domains? Well, if we by "related domains" mean other OPG:s, it's obvious that the things we learn in notpron are useful, especially since many of the other OPG:s use puzzles very similar to notpron's, but whether you can learn things useful in other semiotic domains is difficult to say.

The *critical learning* is harder to establish in notpron. Gee writes:

> The learner needs to learn [---] how to think about the domain at a "meta" level as a complex system of interrelated parts. The learner also needs to learn how to innovate in the domain – how to produce meanings that, while recognizable, are seen as somehow novel or unpredictable.

[6] "n00b" means "newbie" in leet speak (which stands for "elite speak", originally used by hackers)

It's hard to say if all notproners reach this meta-level, but the ones who have created their own OPG inspired by notpron are certainly trying to! (As said before, some of these OPG:s are quite predictable and similar to notpron though.)

Notpron as semiotic domain

Since Gee believes meaning is situated, a specific literacy is always bound to a specific semiotic domain that consists of a unique set of practices and communicated meanings. Gee's next four learning principles (number 2-5) are about different aspects of learning a semiotic domain.

One of these aspects is learning about "the design grammar" of the semiotic domain. It gives a generic understanding through which one can predict what is "compatible" (or not) with the semiotic domain. There are two aspects of the design grammar that Gee explains:

> *Internal design grammar* is the principles and patterns in terms of which one can recognize what is and what is not acceptable or typical *content* in a semiotic domain.
> *External design grammar* is the principles and patterns in terms of which one can recognize what is and what is not an acceptable or typical *social practice and identity* in regard to the affinity group associated with a semiotic domain. (Gee, 2003, p. 30)

Why does Gee use the word "design" here? That is because he wants to stress that the grammar (the rules, the way to think, the values etc) has been designed by someone – they are not given by nature or by God. In notpron it's obvious who is the internal designer – it is David Münnich, and the game is clearly characterized by his personality, his knowledge and skills, his interests and so on. The external design, i.e. the social practices and identities in the connected forum, is to a large extent also formed by Münnich, but also by the most devoted notproners in the forum (especially the moderators appointed by Münnich).

It's quite easy to decide if someone knows the design grammars of notpron. If you don't know the internal grammar you won't be able to solve the puzzles and if you don't know the external grammar of the forum you will be corrected in one way or another (censored by the moderators, flamed by everyone and so on).

On the start page of the game there is actually a section called "Rules" (web page 009), where some of the most basic design principles are listed, for instance: "It's NOT a point and click thing!", which means that notpron doesn't have the internal design grammar of a point-and-click puzzle game, like the games in the "Escape the room" genre for instance (i.e. *Crimson Room* mentioned in footnote 1 above). Another example of an internal design principle on this Rule page is: "Every time you need Google, there is a build in search bar on the riddle page. No need on any others."

One important *external* design principle in notpron is that it is taboo to *cheat* by using walkthroughs to solve the game. The existence of "spoilers" on the web is a vividly discussed issue in the forum and using them is categorically condemned by the notproners. It is forbidden to post spoilers and half-spoilers in the forum and the restrictions have been gradually stricter. Now it's only the moderators that are allowed to post hints and clues in the level threads, and in the levels after level **minus 31** it is forbidden for everyone. In the source code of level 32 one can find this comment: "<!--please don't help anyone to get here. same for the next levels. only very very close friends if you have to-->)"

Player motivation in notpron

One of the reasons behind educators' interest in DGBL is that a good game obviously makes the player very engaged and motivated, and that is something one would like learners in other contexts to be as well. Several of Gee's Learning principles deal with different aspects of this topic, like the player's commitment and achievements, challenges and rewards in the game etc. Not many of these principles are implemented in notpron. For instance, the Achievement Principle (number 11) is described like this: **"**For learners of all levels of skills there are intrinsic rewards from the beginning, customized to each learner's level, effort and growing mastery and signaling the learner's ongoing achievements." (Gee, 2003, p. 67)

Notpron is distinguished from most other games by the fact that it has only one well defined goal, namely to find the one and only possible solution of each puzzle. Therefore, if you want to give the player an intrinsic reward, signaling his/hers "ongoing achievements", you got to link that reward to the player's progress in solving the puzzle, especially to the moment of finding the solution. Notpron cannot evaluate the method you used to find the solution, the amount of time you spent, how much help from others you

got etc, so there is no way to customize the reward to each individual player's skill or cleverness. The game itself can only give feedback/reward when you change the url (or enter username and password in the login window), and that will be the same feedback to everyone.

However, this doesn't mean that all players *experience* the rewards equally. I opened a thread (web page 010) in the connected forum and asked the notproners to describe the feelings they usually experience during the process of solving a level in notpron. "Kisa" answered:

> 1. Collecting clues: Where are they? How are they hidden? And is that what I found really a clue or just coincidence/a filler? That's the curiousity phase :D
> 2. Contemplating about the clues: What do they mean? What could I do with them? Why the hell can't I get anything meaningful out of it? That would be the frustration phase :D
> 3. Enlightenment and trial: Try stuff out, maybe getting fresh ideas. I'd call that the excitement phase :D Sometimes going back to phase 2, sometimes to phase 4.
> 4. Finding a word: Got something? Then gotta try it out! Enthusiasm phase ;) Is it the solution? Then step 5. Just another clue? Back to step 2!
> 5. Yay! Depending on the difficulty of the level, either just a short joy, or a real riddle-orgasm :D AND (if next level exists): Back to step 1 :D (Post by *Kisa* 30-05-2007 12:31, web page 010)

"Shenmue" answers the same question like this:

> I played it because ... well, I will use something Nietzsche said [---] He said that you need to experience bad things to develop, and the tougher life is, the harder the climb up the mountain is, the more wonderful the view is once you reach the top. [---] Well, he used that to explain life itself, I use it to explain Notpron. :P The levels were often a nightmare to solve, they could frustrate me to death. But once I got the answer by myself, the feeling I received was worth all the "pain", the view after the hard climb was almost always worth it all. :D (Post by *Shenmue* 31-05-2007 14:23, web page 010

These two quotes indicates that the experienced gratification in notpron actually differs depending on the difficulty of the puzzle and the effort invested in it, but I don't see that as an interactive feature built into the game itself, but rather as a general psychological response that characterizes (at least some) human beings. The forum discussion about cheating is linked to this topic. The notproners argue that it ruins the pleasure associated with the puzzle-solving, if you receive too much help from others or use walkthroughs. But there are *extrinsic* rewards too, that might entice some players to use walkthroughs. When finishing the game you can get a "certificate" from Münnich that proves you have solved all 139 levels, and you can buy a T-shirt with the text "I solved notpron".

But what if the game is too hard for you? A lot of people obviously don't think it's worthwhile to invest the effort needed for solving notpron. According to the visit counter on notpron's start page, almost 12 million people have visited the start page of notpron, in June 2007, but only 118 of them have solved all the 139 levels of the game. (web page 011). On this start page, the game is presented as "The hardest riddle available on the internet". And it is true that the game demands a lot from the player who wants to beat it without using too much help. One thing the new player needs to learn is the design grammar of the game (and the genre), that we discussed earlier. Maybe cheating in a few levels is a way to do that? (that is, if the used walkthrough describes how to find the solution of the puzzle, not just giving the answer without explanation, of course).

On the other hand the game shows a deliberate ambition in the first levels to gradually get the player familiar with the game's semiotic domain. This is done by explicit explanations on the level's web page, and also through quite easily interpreted hints in the forum. The "Easter Eggs" that you sometimes get when writing the wrong answer in the url, are sometimes encouraging and give hints if you're close to the answer. On notpron's start page there is also an "official walkthrough" for the first 8 levels and in the forum there is a FAQ thread (web page 012), where things like source code and file extensions are explained. In his "pdf-book" about notpron, Münnich (2005) discusses what Gee calls "the incremental principle" that describes the successive increasing of the game's complexity and difficulty:

> Well, It's my job to slowly drag up people, teach them new "skills" in a subtle way. Perfect would be a dumb nut joining Level 1, slowly going up to 80, without any help, because he slowly learns enough, but on the other hand it would be boring again if everybody could beat it. The fact that only

> few can get through sort of makes the riddle interesting and mysterious in my opinion. (Münnich p. 14)

The "regime of competence" in notpron

The latter part of the quote above reveals that Münnich is a bit ambivalent to the idea of making it possible for every "dumb nut" to solve the game. This is of course problematic from an educational point of view. Gee's learning principle, "Regime of Competence" (number 14), states that a good game needs to be "challenging but not 'undoable'" (presupposed for everyone?), but since notpron can't adjust its level of difficulty to each player's individual capacity, it becomes a game for just a few people. Is that bad? A thread in the connected forum discusses that question. It was started by "wharfrat1490" with the following post:

> This f**king game is elitist! Seems to me that if you're going to put up a puzzle in a public place like the internet, the playing field should be level for all comers. What's this crap with having to look through the source code? I thought this was a challenge of the mind not some code deciphering contest for geeks. You really should put a disclaimer somewhere that preexisting knowledge of programming/web design is required. I resent the insinuation that I'm somehow not smart just because I did something in college other than sit in my room and stare at a monitor all day. I'm relieved, however. 1 ½ hrs and 7 levels and it's already one of the biggest wastes of my time. I'm happy to quit.
> Not all intelligent people are geeks
> Not all geeks are intelligent
> Most geeks aren't intelligent at all, they just know some tricks
> Dogs can memorize tricks (Post by *wharfrat1490* 30-09-2005 08:07, web page 013)

"supamom" answers:

> Hmm, interesting! Well, i'm not a geek, never sat in front of a pc until i started work at 18, and never surfed the net until 2 years ago at the age of 37, and guess what.....i managed to get to the end! All with a little help from my friends here of course, but it is possible for EVERYONE not just computer geeks! It seems to be you just can't hack using that brain of yours to figure out new stuff, but that is just my opinion just as the comments above are yours! (Post by *supamom* 30-09-2005 08:15, web page 013)

and "eddy_aus" agrees:

> I'm a Psych major and I'm quite useless when it comes to computers. Apart from surfing the net, the only real reason I use a computer is for writing papers Naturally, the first level that involved source code had me stumped. But that didn't mean I had to give up. Nor did it mean I had to make a thread and cry about it. I just persisted and started clicking my right mouse button all over the place until I noticed the "View Souce" tab when I did. This was seriously the first time I'd even heard of source code. Hell, this game was the first place I'd had a reason to use morse code, ASCII code, an audio editing program, etc. [---] You don't have to be a computer nerd to through the levels. Just gotta be a quick learner and more importantly, willing to learn. (Post by *eddy_aus* 30-09-2005 09:08, web page 013)

And so it goes on, with more notproners assuring they are not geeks, and about the importance of being "persistent", having patience and being willing to learn. One could be enticed to reject notpron as a good learning environment since it doesn't attract a majority of people who tries it. But it does appeal very strongly to a small faithful minority, and to them it has undoubtedly worked as a learning environment.

Concluding thoughts

So what did those people learn according to themselves? In the thread where I asked about the feelings during the puzzle-solving process (web page 010), I also asked what the notproners sensed they had learnt by playing notpron, and also *how* they learned those things. The knowledge and skills mentioned in the answers were computer skills, googling skills, graphic and audio editing, knowledge of source code, etc. – all things that could be included in what is being called computer competence and digital literacy. Answering *how* they got this knowledge and skills, three types of "methods" were mentioned: *trial-and-error*, *googling* (for information, tutorials etc.) and *asking other people* for help and information (other

notproners in the forum as well as friends in "real life"). This means that the actual *learning* of knowledge and skills in notpron isn't really built into the game itself. The game can be said to *stimulate* and *motivate* the player to seek the knowledge and skills, but it doesn't provide the actual information and training environment. But this only applies to the concrete knowledge and skills mentioned above. The notproners also mention more general, generic skills and insights notpron has given them, like self confidence, patience, logical thinking etc. and such abilities are trained while interacting with the game itself.

There are two interesting implications here, I think. The first one is that notpron stimulates the player to seek "peer teachers" both in the real world and in the virtual. In the forum one can notice that the same person alters between being the learner and being the teacher, depending on which game level is being discussed. Whoever has solved a level becomes a master *of that level* and can act as a teacher to the ones who haven't solved it yet. Gee talks about this in his last learning principle "Insider principle" (number 36):

> The learner is an "insider", "teacher", and "producer" (not just a "consumer") able to customize the learning experience (Gee, 2003, p. 197)

The second implication concerns the trial-and-error method the notproners point out as an important way to learn when playing notpron. It is an example of Gee's *active learning principle* discussed earlier, but also of other principles he has found, like the "Probing Principle" (number 14), the "Intuitive Knowledge Principle" (number 22) and the "Discovery Principle" (number 28). In his book *Don't bother me mom – I'm learning!* Marc Prensky (2006) describes how the new generation of "digital natives" learn to think "through experimentation and what real scientists call 'enlightened trial and error'" (Prensky, 2006 p. 8). I think this is a good description of what you have to do in order to solve the puzzles of notpron. Actually I believe this might be the most essential learning method in the digital semiotic domain as a whole. When it comes to computer knowledge and skills for instance, children and young people learn in practice, by *doing*, while the older generation often learns verbally, by reading books and manuals or attend courses with a linear learning system, step-by-step instructions and a focus on learning terms for different features in the computer.

Today's computer applications, mobile phones, TV sets, IPods, DVD players, have all become so complex that few people have the time and energy to read their thick manuals. If you want to learn how to handle all these new digital devices and applications, you have a big advantage if you have the self confidence and the courage to experiment and use trial and error, and OPG:s like notpron could be a way to train this.

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cache 002: *Credits page* on notprons start page. Retrieved June 7, 2007 from http://www.deathball.net/notpron/credits.htm

cache 003: *Other riddles* thread. Retrieved June 7, 2007 from http://forums.gameservers.net/showthread.php?&threadid=20525

cache 004: *Lambda* thread. Retrieved May 18, 2007 from http://forums.gameservers.net/showthread.php?threadid=23341

cache 005: Email from David Münnich, June 1, 2007, Received at 7:54 PM

cache 006: *We never had a "show your ugly mug" thread, eh?* thread. Retrieved May 18, 2007 from http://forums.gameservers.net/showthread.php?&threadid=21899

cache 007: *</notpron> (end of notpron)* thread. Retrieved June 7, 2007 from http://forums.gameservers.net/showthread.php?threadid=23353

cache 008: *Worst game ever* thread. Retrieved June 07, 2007 from
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