The Things We Learned on Liberty Island: Designing Games to Help People Become Competent Game Players

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ABSTRACT

The growing interest in the relationship between games and learning has, to date, be dominated by two traditions of work. The first treats games as potential educational content; the second considers the social contexts of learning from games, but only at a general level. A methodology has been developed that permits the detailed analysis of how people learn from particular instances of game play. This approach is used here to study two approaches to playing *Deus Ex*, one involving the training level and one neglecting this. The analysis revealed the things players learnt, the strategies they developed to progress through the game, the way in which these strategies evolved and also the way in which previous experience was transferred to this new context of play. This analysis permits conclusions to be drawn about the value of training levels and the importance of designing games in a way that recognizes previous gaming experience. The analysis also has implications for defining game genres, for decisions about the inclusion of design features such as quick saves and for the design of AI scripts.

Keywords
learning, play, activity theory, game design

BACKGROUND

Although there has been growing interest in the use of games to support education [e.g. 1, 2, 3], there is as yet relatively little research into how people learn to play games. This is surprising, since VanDeventer and White [4] have demonstrated that competent game players demonstrate several characteristics of expert behavior and Gee [5] argues that there are highly successful implicit theories of learning embedded in well-designed computer games. Yet in spite of this perspective, which treats games as pedagogic texts or designs, there is a paucity of research studies exploring the detail of game play in naturalistic environments [6]. This obviously has implications for design, since the lack of formal analysis means that current practice relies on conventional wisdom; research-based recommendations for design in this context could be provided, but are currently absent.

Symptomatic of this situation is the fact that the emphasis within this research tradition has typically fallen upon the design of the game text rather than on the interaction between text and player. As a result, findings have remained largely inferential. What is a missing is a method that looks at the process and outcomes of play and how this relates to the design of the game text as well as the social and cultural aspect of play [6]. In response to this, a new methodology was developed that uses activity theory [7, 8] to examine educational aspects of game playing practice.

This perspective was piloted with a study of one child's performance within the game *Harry Potter and the Philosopher's Stone* [9]. Within this pilot study, it was possible to document examples of learning to play within four distinct areas:

- Learning to use tools skillfully
- Learning about the properties of in-game objects
- Learning about game conventions
- Learning about spaces within the game

It was also possible to identify a set of six simple strategies that explained all of the player's behavior during the recorded game-playing excerpt (of 30 minutes). These are summarized in Table 1.

Table 1: Strategies that guided play in Harry Potter

1. Spot unusual objects and click on them
2. If you can't progress (e.g. a door won't open), systematically explore the area until you find something you missed (Note: this typically led to uses of rule 1)
3. If you see a block, levitate it onto something
4. If you've run out of things to click on, move on to a new area
5. If you haven't explored an area, do so
6. If there is a threat, move past it carefully (positioning and timing)

Importantly, it must be stressed that these are not rules that were described by the player. They are not the product of self report, generated through interviews or talk-aloud protocols or the like. Such data may be interesting, but as with any area of expertise, it is rare (if not impossible) to find individuals who can perform skillfully *and* provide coherent accounts of their practice, simply

because much of skilled performance is tacit – the practitioner remains unaware of what it is that enables them to be successful [10].

Instead of hoping to find such an account, or rather naively hoping that one could be generated just by asking players to talk about what they do, these rules were generated by studying detailed transcripts of play. Recurrent patterns of activity were closely scrutinized to see what they achieved, and this pairing of motivation and action was then summarized as a strategy for play. This process was repeated across the whole transcript, modifying strategies if necessary to account for related variations in play. These final set of six strategies were the product of this analysis, and they explain all of the observation actions undertaken by the player.

Having been surprised by the simplicity of this account, a more complex game was chosen for study – *Deus Ex*. The intention was to identify (1) whether comparable explanatory strategies could be generated, (2) whether the examples of learning and corresponding strategies were indeed more complex for this game, and (3) whether a structured training level serves a useful educational purpose in preparing players to engage competently with the game.

METHODOLOGY

The approach used here involves close analysis of play. Data has been selected from two players; these cases illustrate contrasting experiences of play. Both were experienced gamers, although neither had much experience with first-person shooters and neither had played this particular game before. Each played for two hours, although their activity in the game differed. One player completed the training level then undertook the first mission (Liberty Island); the second simply attempted to play the first level without prior training. This difference in approach provides a useful contrast that enables us to draw conclusions about the value of the training level.

Game play was recorded using two digital cameras, one focused on the screen, the other set up to record the player (including their use of the mouse and keyboard). The analysis focused on the recording of on-screen action, although sometimes it was helpful to refer to the other video – for example, to establish whether a particular problem was the result of hitting the wrong button. Analysis involved the creation of transcripts that recorded interaction with the game at the level of aim, strategy used in support of that aim, and the detailed tactics or instances of interactions that made up each strategy. (In the terminology of Activity Theory, on which this analysis draws, these three levels are referred to as activity, action and operation.)

Particular attention was paid to moments where problems arose. These might be simple issues, such as an incorrect key press, or more complex, such as realizing that the style of play currently being employed has consistently led to the avatar being killed. In the terminology of Activity Theory, such problems are referred to as ‘contradictions’ and are classified as being one of a limited number of possible types (a full explanation of which can be found in Oliver & Pelletier, 2004). The most relevant kinds of contradiction for the purposes of this analysis are those between subject and tools (learning to use tools more skillfully – such as the game controller, game artifacts, *etc*) and those between subject and rules (learning how things should be used, what they mean, what is valued and so on – in short, the conventions in use, including information about the layout of spaces). Each time a problem was identified, a rationale was provided explaining the particular problem and providing a note to justify the claim. Then, the video was scanned for any evidence that the problem was resolved. (In many cases this happened soon after the problem, but this was not always so.)

Table 2 presents an example of this analysis, for one of the case studies that follows.

Table 2: An example of the analysis of recorded play

Time	Activity	Action	Operation	Contradiction between…		Rationale	Evidence of learning (resolution)
0:00	Designing character	Orienting to skills selection options	Moving cursor in circles around screen	Subject	Rules	Not clear where to focus (attention following wandering cursor)	
		Changing name	Asks: "Is that the only choice, then?" Instructions from Caroline	Subject	Rules	Not clear avatar can be re-named	
			Asks: "Is that my real real name or my real name in the game?"	Subject	Rules	Unsure of identification presumed by game	
0:30			Types own name				Resolves an identity issue
		Assigning skill points	Moves cursor up and down skill list	Subject	Rules	Unsure of how to develop character	
			Clicks "computer" Reads text explanation (mouse as pointer)				Beginning to learn about skills and their purposes

When the player resolved a problem (and there is reason to believe this was not just luck), this is noted as an example of learning. Lists were thus drawn up of the things that each player learnt. As noted, the tables were also scrutinized to identify strategies that explain observed play. The case studies below will demonstrate how these strategy lists did not remain static, but evolved over time.

Finally, any things that the player was able to do without needing to learn anything new – i.e. anything they had already mastered – was noted as an example of transfer. These included both simple things (like saving the game from the menu) as well as more complex things, including styles of play (such as approaching particular areas as if they were part of a platform game).

The list of things learnt will not be presented in full; instead, a selection is included to exemplify it. The section below concentrates instead on the strategies of play that were developed.

FINDINGS

Case study one: Deus Ex, with the training level

This study involved an adult game player who was familiar with a range of titles but had not played this game before. She played the game for around two hours over two sessions, starting with the training level and then undertaking the first mission. Two cameras were positioned to film the screen and her use of the computer, and she was left largely alone to play.

The training level here served to provide a structured curriculum to introduce new players to the game. Twenty five separate activities were introduced and applied; for example, learning how to access goals, how to use items (including weapons), how to move in particular ways (stealthily, how to jump), as well as conventions such as information being stored in data cubes. In addition, eight separate tasks were learned that were not specified by the instructions within the game, such as the fact that the avatar cannot die in the training level and guards can hear you.

The strategies that guided play within this game can be summarized in Table 3:

Table 3: Strategies employed during the training level

1. When moving into a new area, look around to take note of potentially salient features
2. If you're under fire, head for cover
3. When you see cover, crouch and move towards it
4. If one route is repeatedly unsuccessful, try another
5. (If sneaking doesn't work, try running past) – attempted in the stealth section, but abandoned as not generally successful
6. If you can't destroy the threat with the resources at hand, there must be some other resources hidden in the area you haven't yet found
7. If you see an unfamiliar object, right-click it (e.g. books) to see what you can do with it
8. If unable to manipulate an object, browse the menus (e.g. nanokeyring)
9. If you reach an impasse, move through all the information screens (inventory, goals, conversation list, etc.) to see if any information or tool has been neglected
10. If you can't cross a space (meet a challenge?) then try successful approaches from other kinds of game to see if the same strategy transfers to here.

The fact that twice as many strategies are necessary to explain the player's actions, compared to the Harry Potter game (see Table 1), highlights the relative complexity of each game.

A different but related set of strategies emerged from studying how the first level was played (Table 4).

Table 4: Strategies employed on the first level

1. Move through the space until something happens
2. Stay behind cover until you shoot
3. If in combat, fall back to find cover
4. If progress fails, explore earlier areas to find more resources
5. If you see an enemy, hide until they've passed
6. If you see a body, search it
7. After a noisy combat, check and see if anyone else is coming
8. If no one around, then run
9. If challenge too difficult, try another route
10. If stealth approach fails, try shooting from cover
11. If guards running away, shoot them (later this changed to letting guards run away)
12. When you've got past something difficult, save the game

There is a level of overlap between these two sets of strategies – for example, if a route proves too hard, a different one is attempted. Other potentially useful knowledge (such as how to open supply crates) appears to have been forgotten, however. In addition, new strategies have been adopted that were not used during the training level, such as checking to see whether anyone is coming after a noisy combat.

To some extent, variation in strategies used should be expected, seeing as the situations encountered are different. There is also a clear progression, in that some strategies evolve during play (such as

shooting from cover where stealth repeatedly fails, or letting fleeing guards run away as they pose no threat).

In part, progress was driven by recent failure. The tendency to save after each obstacle is overcome meant that attention was focused on solving one problem at a time. Each failed attempt to overcome the obstacle was taken into account in new attempts to progress. This mean that play was experimental, because the consequence of failure is minimized.

The study made clear a number of issues regarding transfer. Firstly, the player used previous experience of games to assess her own ability to carry out particular strategies:

- She believed she was unlikely to be good at a stealth approach;
- She used strafing as a way of moving around stealthily; and
- She expected relevant information to be stored in menus/separate screens.

Her experience in the training level also became a resource to draw on, in this respect, when she played the first level:

- She knew to search bodies for supplies;
- She was skilled at making the avatar jump across gaps;
- She remembered how to aim (letting crosshairs converge) for better effect; and
- She knew how to use particular weapons.

However, there were several examples where transfer failed.

- She was fluent in disarming LAMs in the training level but did not know how to disarm gas bombs in the first level, perhaps because they were represented differently even though the game rules governing them are the same;
- She failed to notice information resources such as data cubes, even though she used these on the training level; and
- She forgot how to open supply crates.

There were also times when a strategy was transferred, but was applied in an inappropriate context, so that the technique was successful but unhelpful.

- She waited for crosshairs to converge before shooting – unhelpful in fast-paced encounters;
- When attacking she favored stealth weapons, even when this was not appropriate (for example, when stealth has already failed and guards have been alerted to her presence); and
- She tried shooting turrets and alarm systems (a strategy that works in other first-person shooters but was not successful with the weapons the avatar had).

What this illustrates is the complex way in which repertoires of play are employed (and tested) in new contexts. Some of these do advance play; others do not, and are abandoned. However, the two

problem areas are the strategies which could be transferred but are not, and the ones which are transferred and which appear to be helpful, but actual impede progress (because they are being applied in an inappropriate context, for example)

Case study two: Deus Ex, without the training level

As noted, player two failed to undertake the training level. This left him ill-prepared for the game, simply not knowing many of the keys required. Some of these were discovered by trial and error, but he failed to learn any of the following during the session:

- How to initiate conversations with characters (right clicking)
- How to open combat supply crates
- How to search bodies for supplies
- How to get more ammo and reload weapons
- What datacubes are
- That you can save progress during the level rather than having to re-start each time

Needless to say, this significantly hampered play. Nonetheless, the player became quite proficient by the end of the session, managing to complete a significant part of the level in spite of this and developing a complex and sophisticated set of strategies for play. (The full list of these is given in Table 5.)

Table 5: The strategies guiding player two's play

1	If you've been shot, look around to try and see who's shooting you
2.	When moving in an area where there are no threats, run through it
3.	When moving into a new area, crouch and head for cover so as not to be noticed
4.	When arriving at a new area, stop and look around (preferably while staying hidden – if necessary, lean out from behind cover rather than moving out)
5.	When moving into an area with threats but no cover, if there's some pushable cover about (such as a crate or barrel), crouch behind it and push it slowly forward
6.	If you've been moving forward for a while, stop and look around you to see if you're passing anything
7.	If you want to get a better look at an area where there might be enemies, move around the edge of a piece of cover so that you only have to scan half the horizon
8.	If you're unsure whether something is a threat, target them and let the 'Friend or Foe' recognition system (crosshair color) tell you
9.	If you see a friendly character, move towards them to see whether they advance the plot
10.	If you see an enemy and can creep past them, you might want to do so *(this strategy was not always followed)*
11.	If you see an enemy but can't creep past them, stay hidden – they might not notice you, and often move away
12.	If an enemy's not moving away, stay in cover and shoot them in the head
13.	If you know an enemy is ahead but you're not sure exactly where, move behind cover towards them and then attack them when you're up close so they have less time to respond
14.	If you see an enemy and there isn't any convenient cover, try a stand off assault (with a variety of guns)
15.	If you see an enemy, and you can't do a stand off assault, try a direct assault (with a variety of weapons, but primarily stun prod)
16.	When you notice your weapon's stopped working (because it's out of ammo) swap to a different one
17.	If combat is going badly, flee for cover
18.	If you've been shot a few times but are currently out of combat, heal the avatar
19.	If stuck, call up the inventory screen and examine items (e.g. to look at different weapons), and possibly re-arrange things on the quick access menu
20.	If one route is proving impossible to traverse, try a different direction

21. If all routes are proving impossible to traverse, fall back and re-explore old areas
22. After the avatar is killed, design the next one with some different skills upgraded (but always upgrade pistol and medical first)

Importantly, these strategies reflect play at the *end* of the session; these were markedly different from the start of the session. Initially, play was dominated by a mixture of exploration and assault. Enemies were seen as targets to be killed. (This is exemplified by the terrorist who is stunned and who the avatar then shoots repeatedly when he's unconscious.) The preferred combat strategy at this point was a direct assault, charging foes with a weapon. This soon changed, however, to being a fall-back option, with stand-off gun battles as first choice. Once the player began to notice the value of cover, covert assaults were introduced as a style of play. These involve moving up in cover towards an enemy and attacking from close range so that they don't have as much time to draw their weapons and respond.

From this, a more general approach to using cover slowly developed. Rather than just running forward along paths, the avatar was moved stealthily through new areas (crouched, avoiding open spaces and light areas where possible, moving from cover to cover), in case any enemies were stumbled upon. Where no cover was available, the avatar was moved alongside a boundary, such as a wall, which provided maximum distance from many threats, a 'safe' direction (so that less of the horizon had to be scanned) and, in many cases, some shadow.

Initially, this stealthy approach was interspersed with examples of direct assaults or stand off gun battles, but these became rarer as play progressed until a stealthy approach dominated. (At one point, there was an all-out assault – a suicidal dash forward through the level gunning down and chasing whoever was spotted – but this seemed to be almost as 'light relief', to provide a contrast to the stealthy action, rather than as a serious tactic.) Earlier strategies – such as, "When arriving at a new area, stop and look around" were modified so as to be executed from cover whenever possible.

Towards the end of the session, the strategies became more sophisticated again. Rather than constantly using stealth, the avatar ran through areas where there were no enemies (because this was faster) and then was stealthy in areas of danger, or in new areas.

Other strategies also developed through play. Initially, skill upgrading was labored as all possibilities were considered. Then, in the face of repeated failure, skill points were all allocated to combat abilities (most frequently, to rifle use). In the latter part of the session, however, skill points were spent upgrading pistol (the most commonly encountered weapon type), medical (since the avatar was always getting injured) and one other skill, seemingly chosen at random – perhaps to find out whether any of the others were actually useful. Some strategies would probably have been abandoned as play progressed – for example, pushing cover (such as barrels or crates) forward when moving into threatened areas, which was tried out towards the end of the session. This provided some protection and a place to hide, but the movement and noise would often draw attention. This would be revealed through further play, leaving no reason to continue using this approach. Similarly, a potentially useful strategy (such as, "repeatedly interact with friendly characters to gain more information") was abandoned because the player could not get it to work – they didn't work out which key they needed to press to do this, and so came to view this strategy as pointless.

Finally, transfer: there was limited evidence of things learnt elsewhere being applied here. The things that appeared to have been learnt elsewhere and transferred to this session, rather than learnt as part of this gaming session, were:

- How to draw weapons;
- Leaning the avatar out from behind cover rather than moving out;
- Attempting to talk to friendly characters repeatedly to learn more information;
- Trying to pick up supplies of weapons/ammo by moving the avatar over crates (unhelpful transfer, since this convention of many first-person shooter games did not apply); and possibly,
- The fall-back strategy of examining items in the inventory when all else fails, which is a staple of point-and-click adventure games.

DISCUSSION

Both of these cases illustrate how the different ways in which players' gaming experience, including previous experience, contributes to successful play. In both cases, strategies were constantly modified in response to things that were encountered – in addition, existing strategies (from the training level, or previous gaming experience) were also tried out as possible solutions.

However, there are marked differences in the ways the players learn to play. The strategies developed, and the reasons for this, related to their previous experiences and knowledge. In case study one, the player changed their approach when encountering new problems in a fairly sequential manner; in the second case, however, after two hours of play the strategies still failed to prepare the player for new encounters. This tells us two things:

1. The development of strategies was strongly influenced by the experience of the training level, which enabled a repertoire of solutions to be developed in response to discrete problems, and which also ensured familiarity with a range of basic operations (such as searching bodies); and
2. That one of the reasons why the second player failed to progress was because he did not save at regular intervals, and so the consequence of failure were much greater. This impeded a trial-and-error evolution of strategies. (This may tell us something more generally about that player's competence with this genre.)

Importantly, the analysis also reveals styles of play. There were marked differences in how the game was approached, how play evolved and which possible approaches were tried. The player in study two spent a long time overcoming his tendency to view this as a confrontational first-person shooter; the player in the first case drew on her experience of platform games in her inclination to explore new spaces, climb ladders and jump around obstacles.

These cases have demonstrated that transfer – previously assumed to be important to but too problematic to study in any detail – can be accounted for. Transfer was a mixed blessing; it provided a wider repertoire of responses to any given situation, but there was no guarantee that these would be helpful. The study also suggests that some players may be better able than others to judge when transfer is appropriate – for example, the player in case one abandoned 'direct assault' as a strategy very quickly, whereas the other player continued to employ this approach through most of the session.

CONCLUSIONS

The purpose of this paper was to explore the implications for design of players' experiences with learning to play the game *Deus Ex*. A number of conclusions can be drawn.

The analysis of play, above, demonstrates the value of the training level in preparing players for the main game. However, it also reveals a number of shortcomings with this particular design (such as the unintended learning that took place) and that it is only a partial support, since many of the strategies that could usefully have transferred, didn't. What was learnt in the training level was also only part of what was required by the player; these experiences were combined with strategies learnt from other games in order to create a repertoire of approaches to play that led to success. What this suggests for designers is:

1. That it may be productive to design the opening of games with options that can be selected depending on the player's previous gaming experience (understood not just in terms of quantity of experience, but also familiarity with particular genres whose influence might support or undercut the intended experience here).

2. That it would be worth undertaking studies of this kind to assess whether their training 'curriculum' actually does prepare players for the game since, as demonstrated here, even in well respected games there can be differences between what was intended, what was required and what was actually learnt.

The study also highlights the importance of establishing what the conventions that hold in this particular game are (such as cues from non-player characters that particular strategies – such as direct assault, here – are inappropriate *in response to behavior rather than in anticipation of it*). Related to this, it may be important to consider how representational cues can be used to indicate to the player that distinct objects are of the same type (obey the same game rules) so that they will be able to transfer strategies learnt for one class of object to other related instances.

The analysis also provides a simple metric for the complexity of games. The number of strategies required for successful play in these sessions is several times that required to play *Harry Potter*, the game previously studied using this method. This is appropriate, given the target audience – but importantly, this kind of analysis permits some kind of metric with which to quantify the relative difficulty of games, which may enable a more appropriate pitching of the difficulty level of titles given their intended audience.

Related to this, the difficulties encountered by the player in case two arose largely from their failure to use the quick save option provided in the game. This oversight serves to illustrate a way in which the risks involved in learning to play can be managed. The trial-and-error approach used by the player in case one was not viable for the player in case two, since the risk of having to re-start the level was too great. This led to slower development of strategies, explaining why the game was harder for him to learn. The inclusion of risk-managing features such as on-demand saving can thus be studied to assess whether or not it is a useful feature in particular game designs.

There is an ongoing debate over the relationship between the narrative and ludic elements of games, which this study also helps to illuminate. The visibly different styles of play adopted in these cases were describable using the approach adopted here. This illustrates the relationship between games as a set of potentials and the way in which these can be realized, making play 'as performance' an analyzable alternative to studying the games purely as text or as practice. It also offers a new way of classifying games that avoids the problematic typologies of genres currently in use. By identifying the different styles that can be used to play a game, classification can be empirically based (drawing on how games are played) rather than based on representational content or conventions employed. Building upon this, it may offer the basis for studying players' functional literacy with games, as they decide (with varying degrees of success) how to respond to new game play experience.

Finally, there is the potential for this kind of analysis to inform the development of AI scripts in games. The field of Human Computer Interaction has long used 'Wizard of Oz' techniques (competent people acting on behalf of a system, to demonstrate proof of principle); a related method could develop here. The study of competent players using the methods outlined here would provide a detailed account of the strategies they employed and the tactics that each strategy comprises. Undertaken in sufficient detail, these could be implemented as AI scripts for game characters, providing plausible behaviors that have emerged from play rather than requiring programmers to guess the rules that would govern suitable actions.

In summary, the players presented in these cases illustrate how competence can develop during play. The description of this process, combined with the identification of features that helped or hindered strategy building (such as the provision of a linear, simple opening, or the failure to use quick saves to support trial-and-error learning), achieves two things. Firstly, it confirms existing assumptions about the kinds of features that can be provided by games to make them playable. Building upon this, it also shows how engagement with the game is strongly influenced by players' previous experience and that taking this into account explicitly in designs could result in more approachable games. Secondly, and more importantly, it demonstrates that such analysis – lacking from the games studies literature to date – is both possible and worth pursuing.

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