Morphology and Meaning in 'Castle Wolfenstein 3D'

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This chapter takes as a starting point the images of episode six level three of *Wolfenstein 3D* (id Software 1992) pictured in fig. 1 and asks "what does the morphology of this level mean?" Potential answers may be found by approaching the images from two different perspectives. The first is as a cartographic image. The second is as a traversable space (fig. 2). To understand the level as a cartographic image this chapter will begin by approaching the picture on the left as a hidden feature or 'Easter egg' and discuss the process by which this Easter egg becomes visible and the way in which this process helps to structure different players' relationships to the game and to the designers. To understand the level as traversable space, space syntax, a method put forward by Hillier and Hanson (1984) for spatial analysis of buildings and urban formations, is employed to describe the relationship between morphology and the experience of moving through the level.

Fig. 1: Episode 6, level 3 of Wolfenstein 3D *as seen through MapEdid*

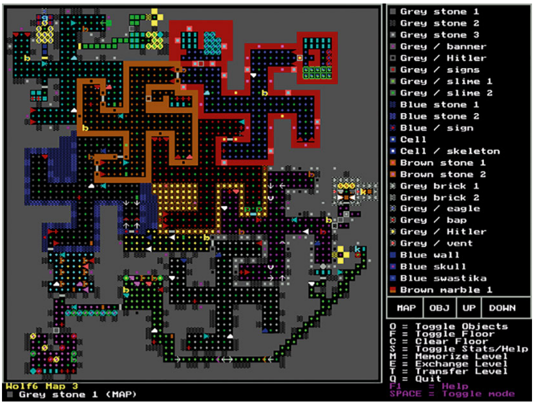


Fig. 2: Wolfenstein 3D *'on the ground'*

The Cartographic Image and Cultural Space

Videogames frequently contain hidden features and content, known as Easter eggs. These hidden features do not advance the gameplay or confer extra powers on the player-character. Rather, it is the fact of their secrecy, and the sense of discovery and achievement they give rise to, that is the source of their pleasure. Easter eggs can be accessed in one of two ways. The first is through extensive play. Here, the Easter egg is a reward for skills and knowledge that is accessible from within the game. The most famous example of this type of Easter egg is the secret room in *Adventure* that featured a message from the game's author: "created by Warren Robinet" (Robinett 2003, vii). This room was difficult to access because it required the player to pick up a hidden pixel-sized dot from one room and carry it to a different one in order to open a secret door. The second type of Easter egg requires specific knowledge or technology that is not available from within the game. In *Streets of Rage 3* (Sega 1994), for example, several of the bosses are playable on inputting certain button combinations shortly before dying. In the Japanese version of the game, *Bare Knuckle 3*, one of these playable bosses is the gay stereotype Ash, but he is removed (both as a playable and non-playable character) from the western versions of the game. However, he can be unlocked as a playable character on the western versions using a cheat cartridge such as the Game Genie. In the first case the bosses are unlocked through knowledge gained from outside the game, for example in game magazines; in the second case Ash is unlocked through technology from outside the game; that is the Game Genie. Most Easter eggs are some combination between knowledge and skills gained within the game and knowledge gained outside the game. For example, to fight Reptile in *Mortal Kombat* (Midway Games 1992) the player must win in the Pit stage when the moon is partially occluded without losing any energy and without blocking an attack. In this case, even knowing how to access the Easter egg from an outside source does not guarantee the player will be able to access it without a great deal of skill in the game. Also, the same Easter egg may be accessed by some players without recourse to outside resources – through perseverance, skill or blind luck – and by others through knowledge gleaned from walkthroughs, game magazines and conversations with other players.

Easter eggs often take advantage of the spatial nature of games, with secret rooms being a popular feature. However, level 6-3 in *Wolfenstein 3D* is a different kind of spatial Easter egg to Robinett's secret room. Here, it is not the rooms that are hidden, but rather the form of the overall space. Or rather the level exists in two different registers – the traversable space and the cartographic image – the first unhidden and the second hidden. Once discovered, both are simultaneously available but not simultaneously accessible. That is, when I am traversing the first level may be aware of its cartographic appearance, but the full resonances of this image do not come home to me. Similarly, when looking at the image on the left of fig. 1 I can imagine what it would be like to traverse, but this is a theoretical rather than practical or phenomenological knowledge of the level as traversable. It is tempting to think of this doubleness as a spatial pun, though the flickering between alternate meanings that is delightful in the pun is not present in this 'double space' since to move from one register to the other is a more laborious task.

Empirically speaking it may be the case that many players come to 6-3 firstly through the cartographic image. However, for most players it is firstly – and perhaps exclusively – encountered as traversable. In any case it is certainly intended to be primarily a traversable space, with the cartographic image a discoverable Easter egg. Even if a player discovers the cartographic image before traversing the game space, it would still be recognised as belonging to the secret, less accessible register. How, then, is this Easter egg accessed? There are four possibilities. First: some players may be able to piece together in their head the overall map-image while traversing the level. Second: players may draw a map as they traverse the level. Third: players and non-players may access the game's code through the creation or use of 'map editor' software designed to view the levels as maps rather than as environments seen 'on the ground.' Fourth: players and non-players may see representations made with pen and paper or map editor software and distributed in magazines or over the Internet. The first two of these possibilities are examples of the first kind of Easter egg, which is discovered through the player's efforts within the game. The third mode of access – through map-editor software – and the fourth – through published images – are examples of the second kind of Easter egg, which is discovered through knowledge and technology from outside of the game.

I am not arguing that the cartographic image in 6-3 is in itself particularly sophisticated. Easter eggs always have some content associated with them – a cool animation, an interesting image, unlocked characters – but the value of an

Easter egg is not necessarily connected to its actual content. Often what is more important is the amount and kind of effort required to access it. *Grand Theft Auto III* (Rockstar North 2001) plays with this fact, making some of its most inaccessible Easter eggs wilfully anticlimactic. Jumping through one fake wall in Vice City leads to a room containing a chocolate egg. Ascending to the top of the Gant Bridge in San Andreas reveals a sign saying, "There are no Easter eggs up here. Go away."

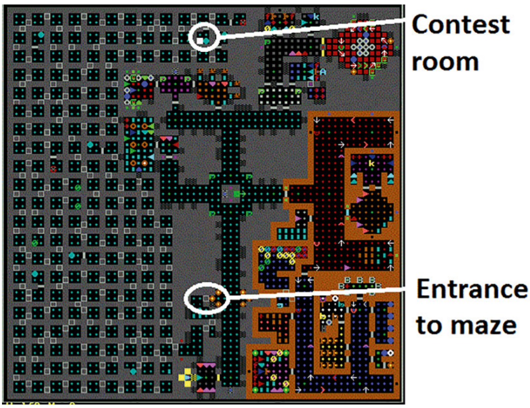
Certainly, the swastikas in 6-3 may be controversial in its use of this sensitive image in an insensitive way, and this may be linked into a reading of *Wolfenstein 3D* as ushering in a particular phase in videogame history where the moral responsibility of the game industry became an important talking point. *Wolfenstein 3D* was released in the same year as *Mortal Kombat*. The U.S. congressional-hearings on the marketing of games to minors would take place in the following year and the ESRB rating system would be launched the year after that. While *Wolfenstein 3D* was not mentioned in the hearings, the 'bad-boy' attitude of its designers is certainly a part of the way in which a new angle on videogames as a harmful form of entertainment emerged in the early '90s (Kushner 2004).

However, the content of this Easter egg is perhaps of less importance than the way in which it categorised its fans. Easter eggs are always about elitism and they always differentiate fans according to some criteria. Depending on the type of Easter egg, these criteria are a mixture of skill, time spent with the game, community membership, cultural knowledge and technological or technical ability. The cartographic image of 6-3 may have been discovered by players around the world in any of the ways listed previously, but it garnered widespread attention through the hacking community who soon after the launch of the game began to release software to edit levels. The most popular and long-lived of these was MapEdit, initially developed by Bill Kirby (Kirby 1992).

In this context, the swastika Easter egg seems to be a nod to the initiated who can access the image through use of this type of software. John Carmack and John Romero, the main founders of id Software, both had an affinity with the hacker community, and, while the enthusiasm with which this community modified *Wolfenstein* may have been unexpected, it was nonetheless welcomed (Kushner 2004). Secrets for those who could access images of the level from above may not have been intended to create a hacker community around the game – they may simply be an in-joke for the developers – but they certainly helped to establish two tiers amongst *Wolfenstein*-fans – those who knew the code and those who didn't. There have always been people interested in modifying games, but *Wolfenstein 3D* seemed to specifically go about rewarding people who engaged with the game on this other level. For example, id Software did not bring legal claims against people who distributed *Wolfenstein 3D* mods online, despite advice to the contrary (Kushner 2004). The accessibility of the swastika image to those who knew the code was just one way of establishing hackers as a special kind of gamer.

However, *Wolfenstein 3D* also contains an example of this benign relationship between hacker and developer breaking down. Perhaps the most famous of *Wolfenstein 3D*'s mazes comes in episode two, level eight, which contains over 150 secret rooms (see fig. 3). This maze contains a boss, an extra life and, in a room that is particularly difficult of access, a message instructing the player to call Apogee, the publishers of the game, and say a code word. According to Joe Siegler, an employee at Apogee, this was originally intended as a competition, but the idea was abandoned almost immediately because software like MapEdit meant the otherwise near-impossible to reach secret room became relatively accessible, resulting in hundreds of calls before Apogee had even decided on a prize (Stoddard 2005). The level works in a contrary way to 6-3: Here the map image reveals a second meaning to the level for those players who have the wherewithal to access the cartographic image. This creates a sense of collusion between the designers and a certain 'class' of gamer. But here, the image as revealed by the hacker undermines the designers' intention. This intention is to reward not the players who, through hacker-developed tools, step outside the game and look 'down into it' but the players who spend hours running around the maze looking for secrets from within the 'legitimate' game space. In 6-3 the hackers and the designers are on the same side, but in 2-8 they stand in opposition.

Fig. 3: Level 2-8; with this map it is relatively easy to traverse an otherwise impenetrable maze



While *Wolfenstein 3D* established a categorical difference between how different people engaged with the game this was by no means set in stone, and the secrets gleaned by those in the know were quickly shared with the community at large, as the 'call Apogee' episode demonstrated. This process only became more streamlined with the development and spread of the World Wide Web. The hit that *Wolfenstein 3D* made with hackers also directly led to the inclusion in subsequent id games of a more hacker friendly architecture (Kücklich 2005). Games in the *Doom* (id Software 1993) and *Quake* (id Software 1996) franchises were specifically made to be moddable, even to people without a great deal of programming ability. Over the course of the 1990s looking 'down into' the game became as legitimate and almost as accessible an activity as playing the game.

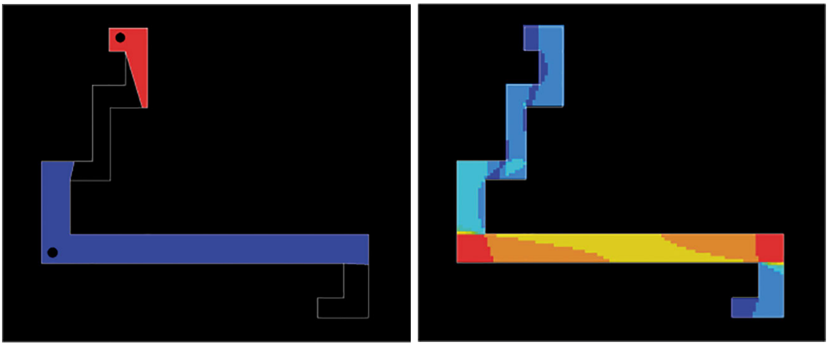
6-3 as Traversable Space: Isovist Analyses

The cartographic register of 6-3, then, points to a particular moment in the history of modding, in which the hacker was both recognised as a special kind of gamer and the fruits of hacking began to be widely distributed throughout the gaming community. But the cartographic image has more immediate formal effects on the game that have nothing to do with controversial Nazi imagery, Easter eggs, or the history of modding. These effects are to do with how a configuration of seven swastikas structures a player's experience of the level visually and kinaesthetically. But how do we get at the range of experiences that the morphology of a particular game space makes available to the player? One way is to create various models of the level as a spatial system. These models help to calculate measures that describe the player's relationship to the environment and how this changes as the player moves about the level. In this way morphology, which is characteristically spatial, is connected to performance, which is characteristically temporal.

The first model attempts to describe how the visual information provided to the player changes. This represents the level as a set of isovists, or view sheds. By looking at the area of these view sheds we get an idea of the amount of visual information the player has over the course of the level. This is based on isovist analysis as put forward by Benedikt (1979) and developed elsewhere (Batty 2000).

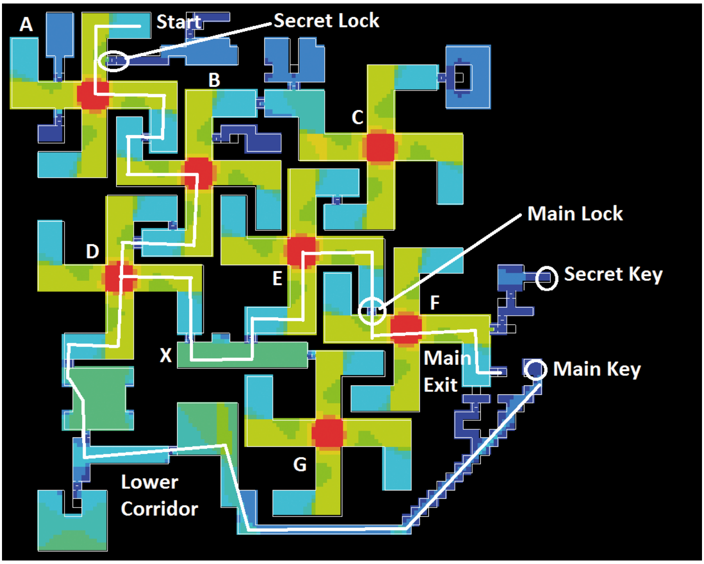
Fig. 4a-b shows a simple corridor system as described through isovists analysis. The isovists in the first image show the area that can be seen from two points. The second image breaks the system into a set of points and represents the area of the isovist from each point in the system. Warmer colours represent larger isovists.

Fig. 4a-b: Isovists in a simple corridor system



In terms of amount of visual information available to the player, the swastikas in 6-3 set up a steady pulse over the course of the level. As the player moves from the end to the crook of the arm, from the crook to the middle of the arm, from the middle to the crossroads, and then back toward the next end, the visual field continually expands, contracts, and expands again. If we take the most efficient route from the entrance to the exit of this level as indicative, the player's visual field expands and contracts in this way several times. Firstly, the player passes through the swastikas marked A, B and D, then enters the very different visual environment of the lower corridor. Here, the visual information is never as plentiful as it is in the main 'swastika area,' but is instead fairly uniform across three corridors connecting two small rooms. The player must reach the end of this sequence, collect a silver key, and then return to the main area. Here, there is the same expansion-contraction of the visual field as before, though this time the sequence is punctuated by the wide corridor marked X between D and E. At the end of F, the player either exits or collects a second key and returns, this time passing through five swastikas in the same expansion-contraction sequence, to the secret exit near the start (see fig. 5).

Fig. 5: Expansion and contraction of visual fields as player traverse level three (white lines show the most efficient route)

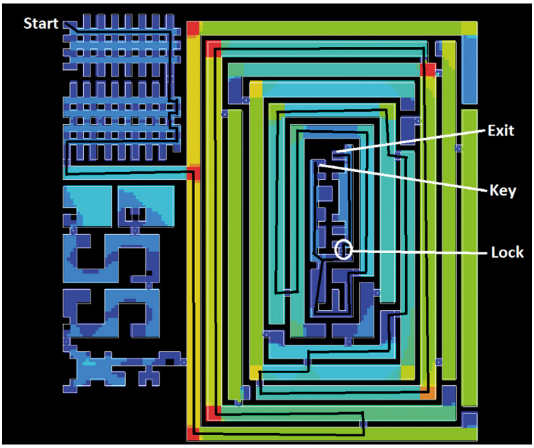


This is an unusual level in *Wolfenstein 3D* not only because of how the level looks 'from above,' as a picture, but also because of how the symmetry of that morphology sets up a repetitive rhythm in terms of the amount of visual information the player has. This in itself can be disorientating, since radically varying amounts of visual information in different areas of the level would act as a landmark that aids navigation. The repetitiveness of the expansion-contraction pulse does not provide this variation and so cannot be relied upon as a means of orientation. Of course, there are other aspects of the environment – such as different colours and textures of walls, different enemy spawn points and patrols, and different statues, pictures, furniture and pickups – that do provide variation across the level and so run counter to this repetitive rhythm.

If we look at the nine other levels in the episode, there is not nearly so regular a pulse in terms of isovist area. In the other levels asymmetry in morphology gives rise to an unpredictability that is central to the game's aesthetic.

We find the 'expansion-contraction' motif in level two, but with a difference (fig. 6). Here, the player begins in an area of small isovists, which is a simple matrix of corridors rather than a difficult maze. This area that affords little visual information gives onto a spiral of long, wide corridors, which have larger isovists, especially at their corners. As the corridors spiral toward the central exit, the visual fields naturally contract, and this contraction is exacerbated at the centre due to the narrower corridors. Here, however, the expansion-contraction only happens once, and not repeatedly as in level three.

Fig. 6: The unrepeated expansion-contraction motif in level two, with an indicative route in black

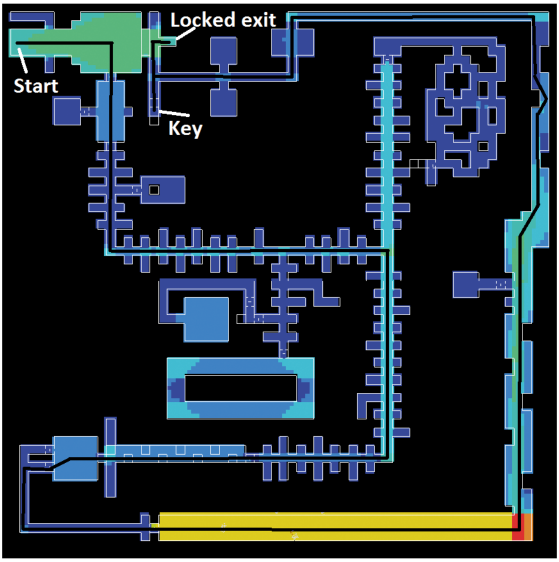


The idea of the second level's morphology giving rise to 'a rhythm' may be a misleading analogy. Because throughout 6-3 the expansion-contraction rhythm is repeated continually, or almost continually, and at a local level, we are justified in examining the most efficient route as indicative of the level's overall rhythm. However, lost a player gets, this rhythm is maintained because the seven swastikas form the core part of the level. But describing the unrepeated expansion-contraction of the most efficient route in level 2 as the level's isovist rhythm is incorrect. In fact, it is only the rhythm of one, or possibly a small number of, possible routes through the level. For example, this rhythm may be disrupted if the player enters the secret maze in the bottom left corner, which, incidentally, contains another possible Nazi-related cartographic image in the sideways 'SS.' But while this may disrupt the rhythm it does not affect the overall pattern that the morphology lays down. Whether the player becomes hopelessly lost, eventually finding the exit after much backtracking, or the player chooses to explore the entire level to collect every item and kill every guard, the entire session will be broadly characterised by this global rhythm because of the low isovist area for the entrance and exit and because of the spiral of decreasing isovist area that separates them. The rhythm will not be as keenly felt by the player who does not take the most efficient path, but nor will it be obliterated completely.

Level three's locally repetitive morphology means that its isovists are relatively uniform across the level. We only get 'blue' areas when we leave the swastika core that constitutes most of the level. Other levels, however, tend to have a lot of smaller isovists and relatively few large ones. That is, the player spends more time with little visual information than with a lot. This is central to the game's sense of pace and surprise.

The combination of areas with large isovists and small isovists leads to variation not just in the way the environment reveals itself to the player but also in the kinds of threats the player faces. Unlike in more contemporary first person-shooters, in *Wolfenstein 3D* the player is generally safer at points with large isovists. This is because, apart from bosses, enemies do not have long range weapons. The only time a trooper or dog, the two most common enemies, has an advantage over the player is when the player does not see them coming. However, large isovists do mean that the player is open to attack from multiple directions simultaneously. Smaller isovists create tension because enemies can easily ambush the player around corners, behind doors or from alcoves, but the player can generally concentrate attention in just one or two directions. Different features that give rise to low isovists such as doors, corner and alcoves, while they all contribute to tension by maintaining a sense of threat, all affect the pace of the level in different ways. Doors that close behind the player were a good way in early first person-shooters to divide up space and thereby increase performance speed, but they also led to a particular kind of rhythm, requiring players to come to a complete standstill in order to open them. Corners also slow the player down, though not to the same extent. The player may also naturally slow down at junctions to decide on which way to go. But the player may pass through corridors flanked by alcoves, such as the one in the centre of 6-1 very quickly (fig. 7). The kind of exhilarating tension felt in passing swiftly down a corridor with multiple alcoves is of a very different character to the anticipatory tension felt before opening the door to an unseen room. The constant tension felt in 6-1's alcove corridor might be contrasted with the oscillation between tension and release that defines the rhythm set up by the 'swastika arms' in 6-3.

Fig. 7: Level one isovist areas with quickest route in black



Visual and Axial Integration

The isovist analysis of 6-3 suggested that the abiding rhythm of the level is one of increasing and decreasing visual fields. But this is a purely local analysis, describing what can be seen by the player at particular points throughout the level. But while locally all of the swastikas in the level are almost identical, giving rise to this regular rhythm, globally they are very different. That is, each occupies a different place in the configuration of the level as a whole. The relative position of each swastika shows up if we look at the decision points and dead-ends of the level on a simplified graph of the level. The graphs used here are a version of the justified graph as put forward by Hillier and Hanson (1984). The method outlined in Hillier and Hanson is to take each room in a house as the base unit of the graph. Then take one of these rooms, usually the entrance way, as the root point, and represent on a graph the interconnections in the house. The graph is a visual representation of how each room fits into the overall configuration from the point of view of a particular root space. Here, rather than taking rooms as the base unit, decision points are taken as the base unit. There are two kinds of decisions in the level, crossroads and junctions. Crossroads offer the player three paths to choose from, plus the path used to access the crossroads. Junctions offer the player two paths to choose from. The graph also shows dead ends, where the player must return on the same path. This kind of graph should give us a visual representation of how each decision point fits into the overall configuration of the level. Figures 8 and 9 show the level represented with two graphs of this kind. Figure 9 shows all of the decision points and dead-ends between the entrance and the key. Figure 9 shows all of the decision points and dead-ends between the key and the exit.

Fig. 8: Graph showing interconnections in 6-3 between entrance and key

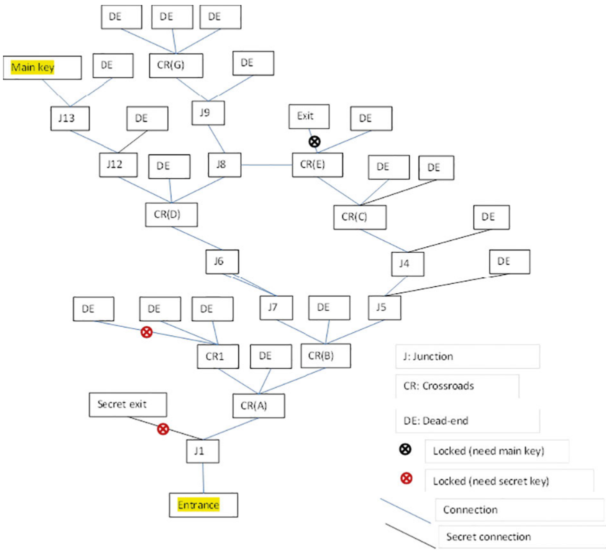
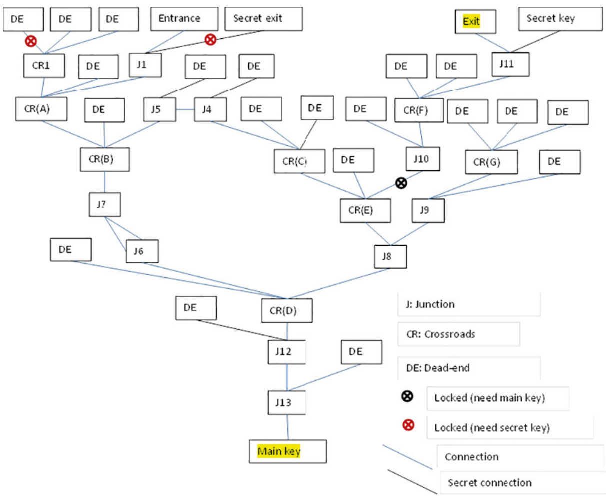


Fig. 9: Graph of decision points for 6-3 for level after the main key has been found



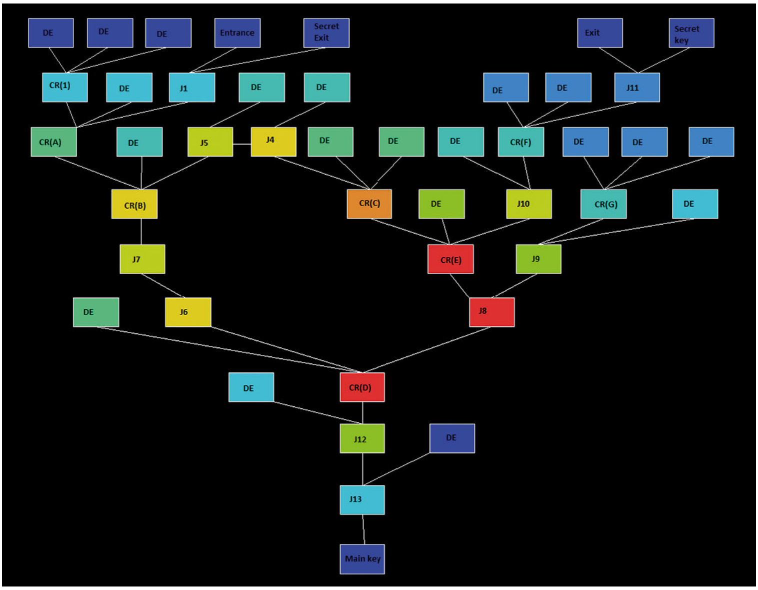
There are two routes between the entrance and the key that do not involve any doubling back. This is due to the 'ring' that links B, C, E and D. Of course, there are many more routes that do involve doubling back, usually a short distance, but slightly longer in the case of J8-J9. If we look just at this graph and imagine that each path has an equal chance of being taken, then the chances of the player reaching the key by either route without doubling back at least once is less than one in a hundred. There are, of course, features of the level that reduce these odds somewhat. For example, several of the decision points are between hidden and visible doors, and in these cases the player is more likely to choose the visible door. However, the odds are nevertheless in favour of the player making choices that do not lead directly to the main key. The player may even make the same wrong decision more than once, since many of the level's spaces look similar. The chances of this kind of error are mitigated by the fact that guard's bodies remain after the guard has been killed and therefore mark a particular space as one that has already been visited. Besides the possibility of making wrong decisions, the player may also purposefully make a decision that leads away from the 'main' path. Frequently dead-ends contain treasure, weaponry and ammo. Getting the key is the only necessary goal to progression, but the player may have many other more exploration-orientated goals. Therefore, there are two reasons why the player may not take the most direct path between the entrance and key: the number of decision points between these two points and the confusion this engenders, and the benefits and pleasures of exploring off the main path.

Indeed, 6-3 makes such exploration likely. If we think of this graph as showing a series of decisions, we can assign different 'levels' which quickly show the distance in terms of decisions between the entrance and particular decision points. The key is nine levels from the entrance, which is almost the maximum distance. This provides the player with many opportunities to become lost or to explore before the key is found. The player, then, may visit many or all of the points on the graph, and may visit them more than once, before finding the key. However, since the player must find the key to proceed through the level (whether through the main or secret exit) there are certain points that the successful player must see at least once. These are the ones marked Entrance, J1, CR(A), CR(B), CR(D), J12, J13 and Main key. On the ring we have two routes that do not entail doubling back. These either take in J7 and J6 or J5, J4, CR(C), CR(E) and J8. All of the other spaces may be visited but are not necessary for progression. The likelihood is, of course, that at least some of them will be visited, but every player who completes this level will certainly see the first set of points and will have at least a one in two chance of seeing the second set. We can use the same method to describe the decisions facing the player between the key and the main exit, and the graph for this is shown in fig. 8.

Now that the rest of the level is accessible the player must go from the main key location to the main exit or to the secret key, which is located near to the main exit. As with the first phase of the level, the departure point and the destination are a large number of steps apart; indeed, in this case the exit is at the furthest level from the departure point. However, at this point the player will have seen much of the level already and therefore may be less likely to get lost. Also, many of the secrets may already have been discovered, and so the player may take a more direct route to the locked door at CRE-J10. Again, there are two routes that do not double back. Just focusing on the crossroads, the first must take in at least D, E and F. The alternative, longer route must take in at least D, B, C, E and F.

If we look at the level in total, we can identify A, B and D in the first phase and D, E and F in the second phase as crossroads that the player must pass through. C is likely to be seen at some stage because it is on one of the optional routes in each phase. G is not on any of the main routes, and so may be missed altogether. This justified graph method can show the relative importance of particular decision points with respect to a root point, in this case the entrance for the first phase and the main key for the second phase. This gives us a set of local measures. However, it has been argued that a feature of 6-3, due to the abundance of junctions and crossroads, is that the player is likely to become lost or to explore off the main path over the course of the level. It might be useful, then, to describe the distance of each point not only from some root point but from every point. This would give a measure of how 'central' a particular point is in general and would therefore be a global measure. One way of doing this would be to draw a justified graph with each decision point as a root. Instead of this laborious process, Hillier and Hanson (1984) put forward the idea of integration. This method takes a particular model of space that divides the space into discrete, interconnected units and then calculates the average number of steps from each point to every other point in the system. This provides us with the permeability of the system, or the relative accessibility of each of its spaces. If we do this with the above justified graph we get the graph in fig. 10.

Fig. 10: Integration on decision points in 6-3. More integrated points have warmer colours

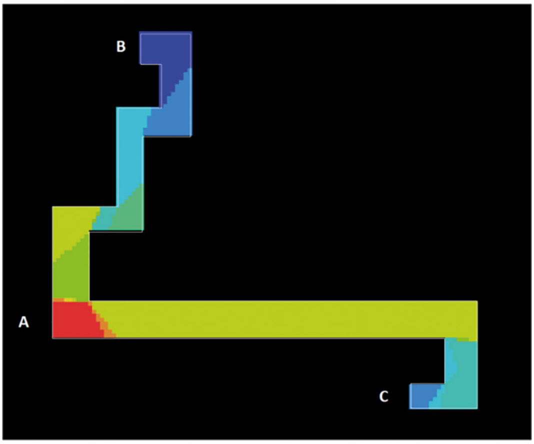


Note that even though the layout for this graph is the same as the justified graph in figure 9, here integration is being calculated in terms of the number of connections required to link each decision point to every other decision point. That is, it is not measuring the closeness of each point to one particular point but the 'centrality' of each point in terms of the system in general. This gives a sense of how accessible a particular point is in general, without taking account of the player's starting point or the position of game goals. It is unsurprising that those points on the ring are highly integrated as they are generally accessible. The further we go from the ring the more segregated are the decision points. The entrance, both exits and both keys are highly segregated, meaning that there are on average a lot of decision points between the player and these areas. Note that D, the only crossroads that must feature in both phases of the level, is highly integrated. Therefore, both the placement of locks and keys and the configuration of the level make D a pivotal point in the permeability of the level.

As mentioned, integration measures the average number of 'steps' from each point to every other point. These 'steps' may be of any kind of unit. In the above example, a 'step' is the connection between one decision point and the next decision point or dead-end. However, we might also define a step in metric terms – that is as distance in feet or metres – as the connection between turns or as any other kind of spatial relationship. Using decision points as the unit for calculating integration seems intuitive, since choice of paths is an integral part of both mazes and videogames. But by modelling the space in different ways we can arrive at other measures which may capture other features of videogame maze navigation.

The two most common ways of modelling space in space syntax research is through visual graph analysis and the axial map. Visual graph analysis extends the concept of the isovist, which describes local visual properties, to describe the global properties of a system. In the example of the simple corridor in fig. 4, isovist area showed us the visual field from particular points along the corridor. Another way of saying this is that the isovist of point A describes all points that are one visual step away from it. It is in this sense a local measure. But we might also think of points that are two steps away from A. These points cannot be seen directly from A, but can be seen by other points in A's isovist. In the same way we can describe all points in a spatial system as a certain number of visual steps from A. Visual integration is a measure of the depth of every point in the system from every other point in terms of visual steps (Turner, 2004). Fig. 11 shows the same corridor system as seen through visual integration analysis.

Fig. 11: Visual integration for simple corridor



Here, the 'central' point A is highly integrated. In a simple corridor like this, the more central points will naturally be visually closer to all points than points toward either end of the corridor. But note that, even though this is a single corridor with no branches one end of the corridor, marked C, is slightly more integrated than the other, marked B. This is because a person standing at B, because he or she is at the end of a twisty corridor, must pass through a large number of visual steps to see most of the other points in the system. A person standing at C, however, because he or she is close to the long horizontal corridor, gets to see much of the system without having to pass through many visual steps. This demonstrates how even in a relatively simple system asymmetries arise in terms of visual integration.

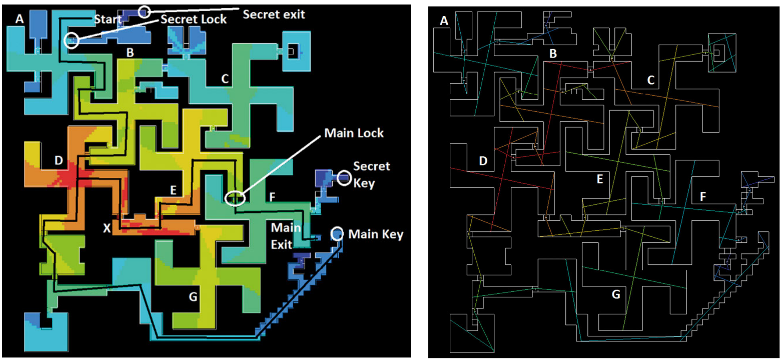
While visual graph analysis focuses on visibility, the axial map focuses on movement. This is a model of the space based on the fewest lines necessary to connect all of the spaces in the system. With this model it is possible to find integration values for each line in a similar way, using interconnections of lines rather than inter-visibility of points. Fig. 12 shows the same corridor as an axial map, with the integration values depicted through line colour. We get a similar result, with lines near the centre of the corridor more integrated than those at the periphery.

Fig. 12: Axial map for simple corridor

What is the benefit of modelling a spatial system in these ways to measure integration? Most space syntax studies look at the relationship between integration and aggregate movement in real-world spatial systems. The movement that can be attributed to the configurational properties of a spatial system has been termed 'natural movement' (Hillier et al. 1993). High correlations have been found between visual integration and movement patterns in public buildings (Hillier/Tzortzi 2006; Turner/Penn 1999; Lu et al. 2009). The axial map has more often been used with respect to street systems, where integration has been found to be a good predictor of pedestrian movement (Penn 2001). Little empirical work has been done with respect to game spaces, though studies have repeated correlations between movement patterns and integration on the axial line from the real world in virtual environments (Conroy 2001) and in *World of Warcraft* (Blizzard Entertainment 2004; Ch/Kim 2007). However, without further empirical investigations claims about the relationship between configuration and player behaviour need to be treated with care. It is important to be mindful of how both local aspects of a gamespace and the particular demands and affordances of the game interact with the space's global configuration.

It must be emphasised that integration is generally used in space syntax to analyse systems in which many users are making journeys from multiple departure points to multiple destinations, for example on city streets and in art galleries. Because integration tells us about the accessibility of the space in general, it fails to take account for the way in which a space might privilege certain journeys and not others. This does not matter so much where users are engaged in different kinds of journeys, since their personal motivations tend to cancel each other out. But in games there tends to be a much more prescribed set of journeys, even in relatively complex spaces like 6-3. It is unlikely therefore that in a level like 6-3 integration will tell us much about player's movement patterns. For example, points like A, J11 and the Main key are found to be highly segregated spaces. This would suggest that there will be little player movement here. But clearly any successful game session must take in these spaces. We would expect a more integrated space like C to attract more movement. However, as we have seen, it is not on a compulsory path and therefore it may be ignored completely. However, permeability may still be a relevant factor in describing how the level's morphology structures player behaviour when the player becomes lost or engages in exploration-orientated behaviour.

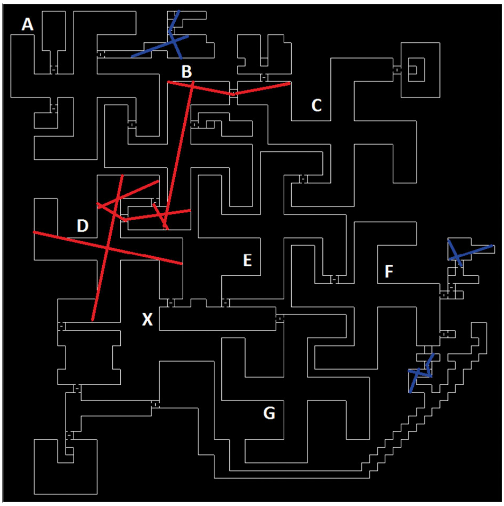
Fig. 13: Visual integration (left) and axial integration (right) for level 6-3, with swastikas marked 1-7



As with the decision points graph, integration on both the visual graph and the axial map is found to be highest around the ring comprising B, C, E and D (fig. 13). However, the visual graph appears less sensitive to this ring as an integrator as it has C, which is on the ring, as less integrated than G, which is off it. The axial map has D, B and C as containing the most integrated lines. This differs from both of the other graphs, which have a highly integrated E and relatively more segregated

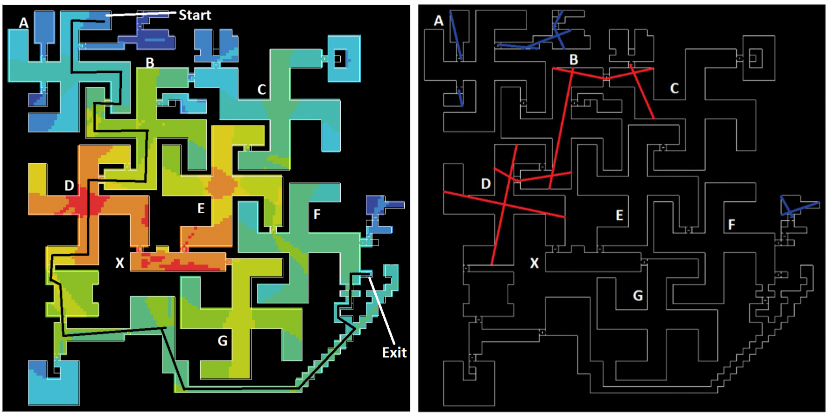
C. The axial map's privileging of C is easier to see if we just display the 10% most integrated and the 10% most segregated lines, as in fig. 14.

Fig. 14: 6-3 with the 10% most integrated lines (integration core) in red and the 10% most segregated lines (segregation core) in blue



Here we can see more clearly that the integration core comprises all of D and parts of B and C. Fig. 13 also shows the most segregated lines in three areas: the room in the bottom right where the secret key is found, the room near the entrance where the secret exit is found, and the small area near where the main key is found.

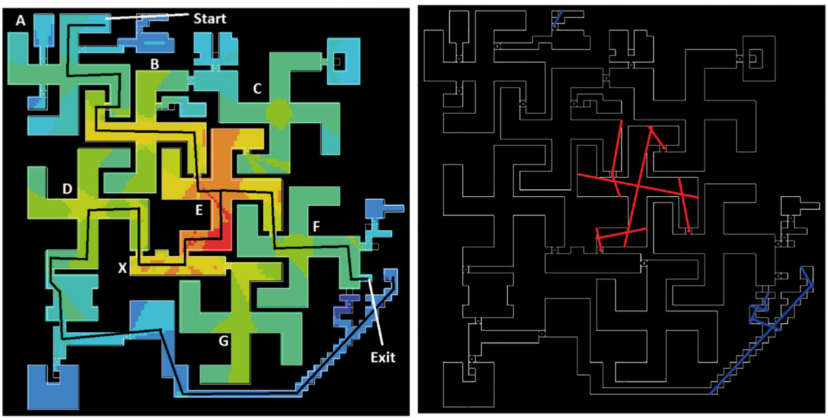
Fig. 15a-b: Visual integration (a) and axial line integration (b) with connection made between F and lower corridor system



We can examine the effect of the level's configuration on integration values by changing the connections in the system. We might suggest that D is highly integrated due to the fact that it is the only gate to the lower corridor. To test the importance of this we can make a connection between the lower corridor and F and see how this affects integration (fig. 15a-b). In this revised version of the level the visual integration core shifts slightly to the right, with E and F becoming slightly more integrated due to the passageway opening up between F and the lower corridor. But the effect is not marked, and D remains a highly integrated space. On the axial map the effect on the integration core is even less, with just a slight movement into C. More noticeable is the effect on the segregation core, with the extra connection to the lower corridor obviously making the lower corridor more integrated.

Perhaps more important than the fact that it is the only 'gateway' to the lower corridor, D has a large number of connections to other subsystems. It is connected directly to B (by two doors) and, through the short central corridor X, to E and G. B has one more connection than D, but it connects to more peripheral areas and so these connections do not contribute as much to its integration values. If we disconnect B and D and add a connection between B and E instead, then we get a big shift toward the topological centre both in terms of the visual and axial integration core (fig. 16). Now E connects up directly to three swastikas and indirectly to two more. At the same time D becomes considerably more segregated because the player must now pass through E in order to access it.

Fig. 16a-b: Visual integration (a) and axial line integration (b) once the connections between B and D have been removed and a connection between B and E inserted, changing the integration across the system



This method of experimenting with connections between sub-systems allows the critic to think about how a particular level works by thinking about how it might work with a different configuration. But it may also be useful in the design process, giving an insight into the character of a level without building and testing it. Of course, this theoretical analysis could not replace the empirical investigation of play-testing and interviews with players but it may help to provide initial clues as to how different configurations might give rise to different experiences by making certain areas more accessible and others less so.

What these integration analyses demonstrate is that even though locally in terms of visual information the swastikas provide a regular beat, globally they each have their own character due to their placement within the system as a whole and the interconnections they allow. Because the more integrated areas are relatively close to all other points in the level we would expect players exploring the level or players becoming lost in the level to revisit these areas again and again, making them an important 'landmark.'

Conclusion

This chapter has attempted to describe two ways in which level 6-3 in *Wolfenstein 3D* articulates meaning. On the one hand, as an Easter egg its form interpellates and helps to construct a certain kind of *Wolfenstein 3D*-fan who can see down into the game. On the other, it structures player experience in the game by alternating areas of high visibility with areas of low visibility in a steady rhythm and, through its system of choice points between sub-systems, privileging certain areas and isolating others. Space syntax is suggested as a means of understanding the relationship between the morphology of a spatial system and player experience in the system. Future research would benefit from more empirical research through analysis of player traces and interviews with players to understand in greater detail the effect of configuration on player behaviour and pleasure.

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