Spatial Design for Multicultural Online Game Environments

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Abstract: Current gaming technologies enable players from different cultures to communicate and participate in gameplay within a single game environment. A player from one culture may now inhabit a three-dimensional game environment developed by designers from a different culture. These game environments bypass geographic and cultural boundaries and question differences in Eastern and Western gameplay preferences recognized by the games industry. This paper discusses the effect of cultural knowledge on the spatial design of three-dimensional game environments. A new methodology for the comparative analysis of the design of three-dimensional game environments is established considering cultural models as applied to design thinking. Based on spatial analysis it offers game designers and researchers metrics correlated to human way-finding in the real world that are directly relevant to the forms of game play in these environments. The initial analysis of internationally popular, and culturally specific, game environments indicate areas where cultural differences may be considered through spatial considerations within a design methodology. Recognized cognitive differences between Eastern and Western cultures and the interpretation of the two dimensional visual field are considered within findings that determine the use of spatial metrics is a methodology that can be used by design researchers and game designers as a toolset within the design cycle of online multicultural three-dimensional game environments.

Key words: Game design, culture, spatial analysis, cross-cultural, design methods

1. Introduction

The digital games industry has developed formats for online multiplayer games where players from different cultures can play alongside each other within the same online game world. This is despite a history of anecdotal evidence from the games industry of cultural differences in gameplay preferences between Eastern and Western game players. Significantly there has been no investigation of this perceived notion of cross-cultural differences that might inform Eastern and Western game designers in the design of these new multicultural game spaces.

As players from one culture may now inhabit a game environment developed by a designer from a different culture the question of how cultural knowledge affects gameplay preferences and the game design process is now of importance to future advances in game development.

The predominant industry design model for the production of games relies on the play testing of games to understand and correct design issues prior to a games release. This is a tried and tested design model relying on the tacit knowledge of the experienced designer and the intuitive knowledge of the tester. Both recognise what they feel is right with the product and use a feedback loop to form an iterative process of design refinement.

The theory of *flow*, "the state in which people are so involved in an activity that nothing else seems to matter" [1], is cited by game designers in the balancing of challenge and the ability of the player to create an engaging and

immersive gameplay pattern. This is inherently intuitive within the design process, recognised as a design skill with no clear measurement except through the subjective responses from game testers informing design decisions.

The games industry has recognised cultural differences in game play and are designing game worlds that players from other cultures may look to achieve *flow* in but if play testers and game designers are from the same culture then there is a weakness in the design model.

This study does not attempt to produce a new multicultural production model for industry but considers how tacit cultural influences within the design process may be determined and discussed by designers in order to consider the cultural differences of game players. It is the author's opinion, as a designer and researcher, that *flow* may remain predominantly intuitive within the game design process but a methodology for the consideration of cultural influence and player preference upon the design elements involved is an industry requirement.

In order to begin to understand the issue this study first outlines industry perceptions of cultural differences and then considers the application of different cultural models to contextualise Eastern and Western gameplay preferences. Nisbett's [2] cultural model establishes a design led context determining the separation of game narrative and game geometry. This facilitates the development of an analytical methodology using spatial analysis toolsets to analyse game environments for indicative cultural differences within their design.

This study analyses three-dimensional game spaces as it recognises how designers and players correlate their knowledge of real world movement with movement in these game worlds. The designer of these game environments relies on a player's tacit knowledge of movement and interaction in the real world to begin to understand gameplay mechanics in the game world. This transfer of experiential knowledge is a common design theory in game design practice with Huizenga's theory of 'The Magic Circle' [3], representing a boundary between the real world and the world of the game discussed by many game theorists [4][5][6]. It offers a basis for analysing where a player and a designer's implicit knowledge, common across cultures, become more culturally specific knowledge affecting design decisions.

This paper is part of an on-going investigation into the influence of cultural knowledge on player behaviour within game environments and on the design of those environments [7]. It does not assume to have solved the issue but to have taken the first steps to consider how design researchers and game designers can begin to address it and inform industry practices.

2. Industry Context

Game development in industry is most often based on knowledge from the prior development of games, the success of game genres, or commercially successful sequels. This is an expected industry model as the development and production of games is increasingly expensive and industry is naturally averse to commercial risks on experimental game designs. The commercial economic markets for games have been roughly delineated by continent and the release of a game may be confined to a single market due to sales data on game play preferences for particular markets. When games are released across different regions they may be localized not only for language, but also for gameplay and aesthetics to fit industry knowledge of different markets [8].

A consequence of this model is that over time market divisions in game sales may have developed because of the influence of risk adverse marketing teams relying on historical sales figures. This study does not intend to

statistically analyse historical sales data in depth but it is wise to consider why some cultural preferences are so pronounced and still resonate in today's marketplace.

The First Person Shooter (FPS) genre has traditionally been seen as a popular Western game with Role Playing Games (RPG) as more traditional to the Japanese market. This has been stated as recently as 2011 by Naoki Aoyagi, CEO of Japan's largest mobile social games network, when asked about its move to develop Western markets. "*I think some content works globally. Some content is very local, so it's a combination. For example, even in traditional gaming, I use an example, some content like sports games they are popular in the worldwide, but some contents are very local -- like Japanese RPGs, or the FPS in the U.S. and Europe. The sports game in, say, each country*." [9]

This traditional notion is now brought into question through online multiplayer games and the increasing accessibility to the FPS genre through the online free to play game mode that has increased the number of FPS players globally. The South Korean developed Cross Fire [10] reached three million concurrent users in China in September 2011 [11]. Special Force [12], also developed in South Korea, accumulated 4 million registered users in Japan historically identified as not a commercially significant market for FPS.

Due to the limitations of network data transfer initial developments in multiplayer games used server technologies that kept players from different geographic regions from encountering each other. The increase in data transfer speeds meant FPS could enable small numbers of players, around 2 to 32, to access game servers in any part of the world.

Massively multiplayer online role-playing games (MMORPG) use server technologies to create persistent worlds where thousands of players may inhabit the same environment. Initial developments used separate servers for different geographic locations but Eve Online [13] uses multiple servers to create a single game universe for all players from around the world. World of Warcraft [14] was developed with separate servers for Chinese players though some players prefer to access foreign servers. Cultural gameplay differences have been demonstrated with the transfer of the real world cultural practice of *guanxi* into World of Warcraft [15]. These unexpected cultural gameplay behaviors indicate the need for more culturally diverse thinking within game design processes.

2. Cultural Models Applied to Game Design

The use of cultural models is prevalent across academic fields so the consideration of how they might inform an understanding of historical game preferences is essential in order to determine a methodology.

Hall's cultural model defined the concept of high-low context cultures examining messages and the flow of information within a culture. High context cultures use messages that are expressly implicit where information is contained within the context of the message. Low context cultures use explicit messages and the meaning of the message is clearly realised within the message itself with little or no hidden meanings. The design of gameplay goals within games requires different levels of context in order to pass a message to the player of what gameplay actions they should take. FPS games require low context messages easily read while moving around the environment at speed. Role playing games use high context messages contained in visual clues and knowledge referenced within game environments. Low context cultures include North America, England, and Germany while

high context cultures include China, Japan and South Korea. If historical game sales statistics and boundaries were considered then this model would support the preference of FPS over RPG games in Western game markets.

Hofstede's cultural model is commonly used in studies across different academic disciplines and discusses culture as a collective phenomenon where the "collective programming of the mind " [16] differentiates groups or categories of people. It has a core area of values that classify nationality and culture through a Value Survey Module questionnaire exploring six dimensions. In this model the USA and Great Britain exhibit significantly higher individuality values than Japan, South Korea or China, indicating a preference for looser social frameworks. This *may* relate to the success of the FPS genre within the USA and Great Britain, as there is inherently more freedom in these fast competitive games and less need for structure within team play. Japan has a higher individuality than South Korea and China with a much more significant difference in Masculinity vs Femininity (MAS) values representing a preference for heroism and reward. This *could* relate to the success of narrative based heroic RPG's that have been hugely successful in Japan but not faired as well in other markets. Higher Long Term Short Term Orientation values also indicate a possible propensity for greater context in game narratives that comes with RPG's. Higher MAS property alongside the high uncertainty avoidance property would indicate an avoidance of FPS with their quick fire and random team play.

Nisbett's model of culture does not offer key measurable dimensions with nationality but concerns itself with how Eastern and Western cultures differ. Mental processes including areas of thought, perception, attention, organisation of knowledge and understanding are used to define Eastern and Western cultural differences [2]. Nisbett suggests that Westerners are analytic and see their world in terms of goals and individual elements, looking for the rules that govern these in order for them to control events. Eastern thinking is holistic: it considers inter-connection, in order to understand a part you must understand the whole because everything is in a state of constant change and each part has an effect on all of the others. It could be considered that a Western player may prefer more goal driven games and an Eastern player more narrative based gameplay. Game design balances goals within encompassing narratives so a game's design may result in different cultural interpretations of a single game depending on how it balances these to create *flow*.

Nisbett and others [17] [18] evidence how these cognitive differences directly affect the interpretation of the visual field and objects within it. Subjects from Western and Eastern cultural backgrounds perceived the relationship of objects within test images in different ways. They offered different narratives for the structure of the elements within the image. Nisbett's original study has evolved into studies using single images, photographs of city environments, animation and web sites. This indicates the interpretation of the game environment, a two-dimensional display on screen of three-dimensional data, will also be affected by these cultural differences.

Faiola et al [19] suggest from their study using web pages that web design should be carried out according to Nisbett's cognitive theory in order to enhance perception and usage. Users performed better when using a website developed by a designer from their own cultural background than a comparable website designed by a designer with a different cultural knowledge. A study by Boduroglu et al [20] offers a practical issue for the design of screen composition as they demonstrate that East Asians are better than Americans at detecting colour changes when a layout of a set of coloured blocks is expanded to cover a wider region and worse when it is shrunk. East Asians are also slower than Americans are at detecting changes in the centre of the screen.

These cultural cognitive differences in the interpretation of images require recognition if designing multi-cultural game spaces as cultural differences in the interpretation of the screen may offer differing game experiences. It is essential to consider how the two-dimensional screen image of a three-dimensional environment is to be interpreted without offering gameplay advantages due to cultural differences.

In conclusion Hall's high–low context and Hofstede's VSM may, to some extent, correlate nationality characteristics, organisational characteristics at the individual level in relation to game sales. It is however Nisbett's model, indicating cultural differences in the interpretation of the visual field, that is directly applicable to design practices and possible cultural differences in the interpretation of images on screens. If it is possible to analyse game environments for the elements that construct a player's visual field, extrapolating visual parameters within the image, then design elements may be determined in order to balance the visual field as seen by players from different cultures.

3. Imageability versus Intelligibility: Developing a methodology

A method for the deconstruction and comparison of the elements that form the screen image for a player from any point in the three-dimensional game environment is required in order to begin to understand what may influence gameplay decisions. Analytical methods developed within the academic fields of architecture and the built environments, exploring how people navigate real world environments, prove useful in this as they correlate with the application of real world knowledge used in game environments.

Lynch developed the theory of imageability [9] based on how the visible elements in an environment will affect a person's navigation through it and is referenced by several game designers [21][22][23] as offering design methods useful in the construction of game environments. Initial investigations correlate with Lynch's interpretations as game environments contain the same elements; paths, edges, districts, nodes and landmarks as referenced by Lynch to develop theories on imageability. Professional game designers use these elements to contain and direct players around an environment. This correlation of the criteria for reading a real world environment with the game environments examined in this study makes sense when considering Lynch has identified the key elements a person uses consciously or subconsciously while navigating an environment. These will be the elements a professional designer will at some point focus on when recreating a real world environment.

In the development of game environments it must then be considered how the imageability of a player's view from a location affects their actions and how this might be analyzed. A game environment consisting of three-dimensional geometry textured with a narrative aesthetic has already been influenced by the cultural references of the designer. In order to analyze the influence of elements within the environment a methodology to extract geometric information from the narrative aesthetic is required to allow their separate analysis.

Intelligibility is defined by Hillier [24] as the connection and integration of the spaces that form an environment. Intelligibility and imageability were considered as unrelated methodologies by their respective fields until the paper *The syntactical image of the city: A reciprocal definition of spatial elements and spatial syntaxes* by Conroy-Dalton [25] explored the relationship between them.

It can be seen why they were considered different when you consider their approaches. Imageability focuses on the visual qualities of an environment elicited from the users of the environment while intelligibility is concerned with the underlying structure in relation to observable behaviour of users in the environment.

In comparing the two systems Conroy Dalton & Bafna concluded there is a relationship between imageability and intelligibility. The hypothesis was that an imageable environment is also intelligible but an intelligible environment does not have to be imageable. A simplistic explanation is to say that an underlying structure in an environment may be seen within the visual differentiation of elements but importantly a structure itself is not dependent on visual elements indicating it.

Intelligibility can be considered to relate to game design functions of the structure and control of player movement within the environment and imageability offers an understanding of game design functions in terms of the subjective response to an environment affecting player movement. These methodologies are proven within their respective fields when applied to real world environments correlating directly to how a person navigates an environment. This meets key criteria for the investigation of the transfer of implicit cultural knowledge into the design and implementation of three-dimensional game environments.

Intelligibility, seen through the perspective of imageability, offers a methodology that can bridge primary game architecture in terms of geometry and the more subjective secondary game architecture in terms of elements such as narrative texture.

4. Intelligibility Through Space Syntax Measures

Space syntax examines the structure of an environment and this field of study has developed methodologies for the measurement of urban layouts that correlate with the way people navigate environments [26]. Metrics relating to the information used when making navigational decisions have been proven to be a method for quantifying spatial relationships and for modeling how users will navigate environments [11].

Space syntax offers a methodology for the statistical analysis and interpretation of the geometry in a game environment. It can offer information based on measurements across the whole environment or from a single viewpoint. This offers a comparative methodology of the spatial properties of environments in order to highlight cultural differences in the design and navigation of the geometry that makes up the field of view in a game environment.

An isovist is a measure of the field of view from a single point within an environment. It is calculated by creating a two dimensional polygon of the visible area which may then be used to calculate individual isovist properties. These properties include; the isovist area, the length of the isovist perimeter, how much of an isovist perimeter is occluded and how complex a perimeter shape is.

It is important to consider how any measurement may be interpreted within the design process for a game environment and its relationship to the gameplay within the environment. In terms of game design and the analysis of an environment isovist properties equate to certain spatial values that may affect gameplay. A large isovist area may indicate a large open area or an apparently smaller area that may be seen from a greater distance. Any occlusion in an isovist perimeter indicates unseen danger, as it is a point of entry that an opposing player may enter from. The larger the occlusion value of the isovist perimeter the more likely it is that an opposing player can enter unseen into the isovist. Isovist compactness measures how jagged a perimeter shape is equating to the complexity of a boundary that may prove difficult for a player to interpret visually within fast paced gameplay. In figure 1 the position of player 1 demonstrates a complicated isovist view field with occluded edges in red and Player 2 hidden from the field of view of Player 1.

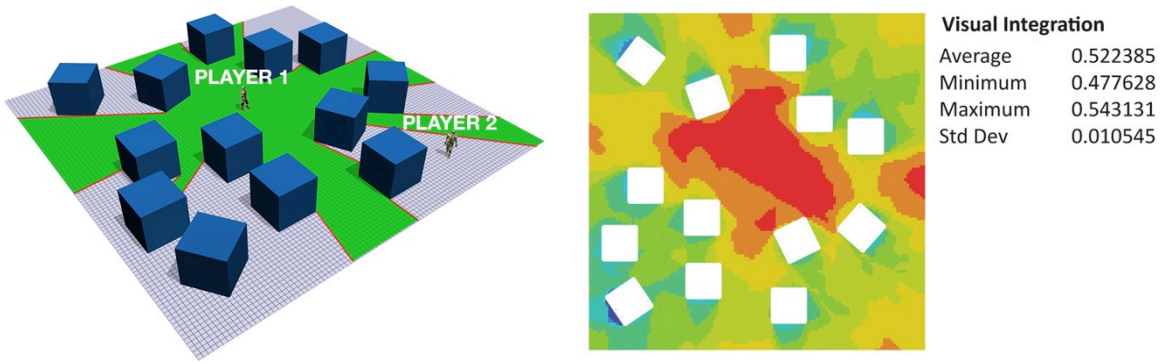

Fig. 1. Players within an environment and a Visual Graph Analysis (VGA) of the same environment.

When these isovist properties are interpreted alongside each other they offer statistical interpretations valuable to analyzing gameplay spaces and their design. A large area coupled with a high occlusion and a jagged perimeter means this is not a safe area for a player to remain in, though if the designer then places within this area an object may offer a player some form of protection it becomes a tactically important area.

Individual isovist data is useful for singular locations in a game environment but the development of visual graph analysis (VGA) takes the understanding of isovists and applies it across an environment to create values for the whole environment. A grid is applied to the environment. An isovist is drawn from the central point of each grid square. A statistical value can be calculated across the grid. Each cell of the grid can be coloured in order to provide the designer with a simple visual representation of the characteristics of the map. In this way a pattern of visual relationships across the space is revealed which will indicate areas of interest to the game designer. Statistical analysis of individual areas and comparisons of environmental characteristics is possible and way-finding algorithms using this information have ben proven to estimate human movement patterns through space [12] that may inform the design process.

A property of the grid system is the ability to calculate relationships between different points and the relevant view fields within the environment. The calculation of visual integration analyses the number of visual steps required to reach other points in the environment. This can be used to calculate a range of statistics, including the mean depth of a point within the environment or the number of visual steps, for example turns a player may need to make, to other points in the environment. The use of the number of turns as an analytical property equates with the nature of a game environment because distance is often not taken into account by a player as their in-game speed is not realistic. In a fast paced game a player may make the minimum number of turns while moving quickly around an environment. The visual integration property indicates within a game environment the areas that a player, moving quickly around a map and using minimum turns, is most likely to move through and keep returning to. This may also indicate an area where players are most likely to encounter each other. The statistical property of visual integration based on the shortest number of turns to any other point in the environment can be normalized so comparison across multiple environments is possible.

In conclusion spatial analysis offers many parameters that can directly inform the game design process and enable the analysis of individual locations in an environment or the whole environment for comparative studies across different environments.

5. Experiment: Spatial Analysis of *Counter-Strike* Environments

Initial investigations use environments from *Counter-Strike* [13], chosen due to its long history after being first released in 1999. It offers the opportunity to study several categories of game maps; professionally designed environments, player designed environments, environments used in the World Cyber Games and environments focused on an Asian market.

Counter-Strike server details were collected every hour over a period of seven days from an international game-monitoring site to assess the most popular maps for *Counter-Strike*. The results of this data enabled a choice of fifty maps that were then researched to establish their authorship as professionally designed or from the mod (amateur) community. The analysis of amateur environments is deemed important when considering cultural practices as these environments are free from economic influences, or industry constraints, so may demonstrate clearer cultural differences. De_dust2 was the most popular map from the server sample with 2,572,870 servers running the environment. This was nearly four times greater than the next map de_inferno at 659,430 servers.

In 2008 a version of *Counter-Strike*, called *Counter-Strike Online,* was released [14]. It had been developed specifically for the Asian market by Nexon Corporation, who are based in South Korea. This game contained several exclusive maps designed for its target market by Nexon along with some pre-existing maps.

The groups for analysis were fifteen professional maps, fifteen mod maps, five maps from the Asian release of which three are completely new maps and five of the professional maps that are used in the World Cyber Games. De_dust2 was also analyzed as a comparative measure to examine possible design characteristics that make it so significantly popular globally.

5.1. Initial Results

The data collected from each map was assembled to examine both the average value and as the data is non-parametric the median of each spatial variable. A Mann-Whitney U test was conducted to evaluate the hypothesis that there is no difference in spatial properties between the sample of professional and the sample of amateur designed maps. This was carried out to test the validity and robustness of this methodology.

H_o: The two samples come from identical populations

H_a: The two samples come from different populations

The results of the test were significant within the property of visual integration for both the average and median values, the results of the test where in the expected direction:

Averages: $z= -2.841$, $p<0.05$ ($p=0.004$)

Medians: $z= -2.551$, $p<0.05$ ($p=0.011$)

The visual integration value for professionally designed maps indicated a more complex environment than found in the selection of amateur maps.

When the maps are examined by game type the mod maps include ‘awp’ and ‘fy’ forms of gameplay. These are gameplay types developed by amateur mapmakers independent of professional developers. These were not traditionally packaged with the game until the development of Counter-Strike Online for the Asian market. An ‘awp’ map is where the players are limited to using long-range gameplay mechanisms. In order to accommodate this form of gameplay most maps contain larger open areas and greater distances in order to test the player’s skill.

This is evident within the data with high values for visual integration, isovist area and for the isovist maximum radial property (the maximum distance from the center of an isovist to its perimeter).

The ‘fy’ map is known as a fight yard where weapons are scattered around a small map allowing players to practice with different weapons. Within the sample analyzed these maps are the second most integrated after the ‘awp’ maps as they contain open spaces containing a range of objects for cover. The size of these maps for gameplay is indicated in the below average maximum and minimum radial measurements indicating smaller areas with closer gameplay. Without ‘awp’ and ‘fy’ maps the alternative hypothesis of a difference between professional and amateur maps is still significant with $z=-2.176$ and $p<0.05$ ($p=0.03$).

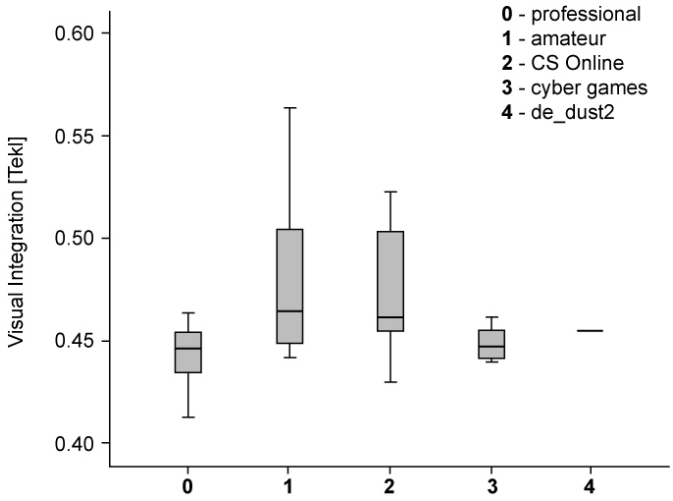

Figure.3 Visual Integration across the 5 sample sets

Figure.3 illustrates the visual integration values using a box plot across five sample map categories. The professional maps demonstrate more complexity in their environments than other categories indicated by the lower integration values. The World Cyber Games category shows a narrow integration range: as would be expected in order to offer a parity of experience across all maps used in the competition. The Counter-Strike Online map pack reflects the popularity of more open environments encountered in current amateur maps. De_dust2 on its own in category 4 but contained in categories 0, 2 and 3 appears to reflect the overlap in the categories.

The difference between the numbers of servers running the de_dust2 map compared to any other map indicates a preference for the gameplay de_dust2 supports that is not just the defuse, ‘de’ prefix, game format as servers for other ‘de’ maps were recorded in much lower quantities.

A scatter plot analysis of de_dust2’s spatial characteristics was undertaken in order to examine the correlation between visual integration values and other variables identified as relevant to gameplay mechanics. The variables examined were isovist perimeter, isovist occlusion, maximum isovist radial and the compactness of the isovist.

The scatter plots showed a visual trend for de_dust2 where values appear to be grouped tighter than the other maps examined. A comparison of the R^2 values demonstrated that de_dust2 is more consistent in the correlation of visual integration to the four spatial variables than the other maps tested. This balance of isovist size, occlusivity,

complexity and maximum distance for de_dust2 compared to other maps may offer an insight into gameplay preferences for an international market as opposed to cultural differences.

Table 1. R^2 values across maps

Map	Occlusivity	Perimeter	Max Radial	Compactness	Mean
de_dust2	0.617	0.568	0.367	0.684	0.5590
de_nuke	0.619	0.606	0.353	0.252	0.4575
de_clan1_mill	0.44	0.513	0.371	0.247	0.3928
de_inferno	0.189	0.262	0.253	0.23	0.2335
de_dust	0.259	0.214	0.147	0.227	0.2118
de_train	0.007	0.14	0.273	0.088	0.1270

The map awp_greesia distributed with Counter-Strike Online for the Asian market is a slightly altered version of an amateur map awp_india. The immediate visual difference between the two maps is the placement and size of several blocks within the large open game space. A spatial analysis of the two maps demonstrates how the relatively small alterations change the overall correlation between visual integration and the other spatial measures.

Table 2. Demonstrating the small spatial alterations to awp_india to create awp_greesia

Map	Occlusivity	Perimeter	Max Radial	Compactness	Mean
awp_greesia	0.67	0.796	0.544	0.576	0.6465
awp_india	0.585	0.804	0.721	0.316	0.6065

The defuse maps distributed with Counter-Strike Online contain several maps created specifically for this release and an analysis of two maps de_tunnel and de_rex comparing their average correlation with visual integration in the four spatial properties places them higher than all the popular maps analyzed except de_dust2.

Table 3. Analysis of the defuse ‘de’ maps

Map	Occlusivity	Perimeter	Max Radial	Compactness	Mean
de_dust2	0.617	0.568	0.367	0.684	0.5590
de_tunnel	0.809	0.857	0.016	0.461	0.5358
de_rex	0.503	0.602	0.529	0.342	0.4940
de_nuke	0.619	0.606	0.353	0.252	0.4575
de_inferno	0.189	0.262	0.253	0.23	0.2335
de_dust	0.259	0.214	0.147	0.227	0.2118
de_train	0.007	0.14	0.273	0.088	0.1270

The analysis of how to design game environments using these measurements could prove useful in developing theories for the design of environments that meet the global preferences demonstrated by the international popularity of de_dust2.

6. Conclusion

This paper is part of an ongoing study into this area and the first goal was to establish appropriate design research methodologies for the analysis of game environments that are relevant for design interpretation and feed back into a design cycle. Cultural models have led to a valid methodology for the analysis of game environments where spatial metrics can statistically inform the design of environments through metrics directly applicable to gameplay.

The analysis of maps developed specifically for the Asian market provides a starting point to correlate data with Nisbett's model of cultural cognitive differences but this needs to be investigated further through a larger sample. These maps are smaller than other maps with more complex and detailed player view fields while earlier maps were larger with more open spaces. The ability for East Asian players to process more complex screen environments may indicate a preference for the smaller more intense gameplay involved in these environments where there may be a lot of pixel movement at the periphery of the screen.

The development of gameplay in larger open environments allows more focused gameplay where the center of a player's view field is the primary concern and large isovist radials encourage this tunnel vision. This would be preferential for Western players using this cultural model with the larger playing area allowing a player to focus on the center of the screen while still picking up pixel changes such as other player movement at the periphery of the screen due to the more consistent image when large distances are involved.

The map de_dust2 is globally the most popular map played and analyzing the spatial characteristics of the map offers clues as to its popularity and further to the possible requirements for globally popular game environments. The map is characterised by enclosed areas, simple visual fields, low occlusion and smaller isovists. These could be said to be design characteristics that balance the visual field requirements of both Eastern and Western players. The analysis of de_dust2 equates to a particular set of gameplay characteristics: it is safer to move quickly and there are distinct areas that a player must move between but long visual fields which allow the player to see further.

It remains to be seen through ongoing studies if this methodology for the analysis of game maps offers more evidence for the hypotheses that cultural cognitive differences will be evident in the design of game environments. The next stages for this study are the further analysis of different environments and to explore metrics in measured test environments in order to inform designers of values suitable for cross-cultural gameplay.

What this study has proven so far is that spatial metrics is a methodology that can be used by design researchers but that it can also be used as a toolset within the design cycle by game designers.

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