

Spatial Context of Interactivity

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1. Introduction

This paper is based on a premise that dramatic engagement, which expresses an author's intent, is desirable as a fundamental capability of compelling and meaningful virtual environments (VEs). The spatial context of navigable, real-time, three-dimensional (RT 3D) VEs is discussed as a resource for the production and manipulation of meaning and drama. Interactivity, with its support for free exploration, experimentation, and behavior modeling, is an essential feature of VEs. The unique ability of computers to support simulations, positions them on the brink between systematic and situational orders. This paper argues that in navigable VEs, space/place is the setting for and part of the action, and that interactivity and meaning cannot be divorced from the spatial experiences that deliver them. A VE is only accessible to users' direct experience through a layer of mediation: it exists as navigable experiential space/place only in the user's mind. This paper proposes that the mental image of this space/place is distinct for each user and can be actively manipulated with the use of mediation devices. An integrated approach to the design of VEs – considering spatiality, interactivity and mediation together – can provide access to an extra set of expressive means, unique to this emerging medium.

The paper consists of three sections. The first, *Meaning in Context*, discusses how meaning is integral to places. The second, *Access to Meaning*, asserts that in navigable VEs meaning is dependent on interactive access. The final section, *Meaning in Mind*, proposes that mental images can be shaped via cinematic mediation.

2. Meaning in Context

A. Space as Experience

We 'dwell' in spatial environments and are present there through our bodies [11][26][39]. The spatial environments of our lives contain information that is available through direct experience and is perceived as a set of affordances: as opportunities and constraints for action [21]. Understanding of abstract notions also depends on our ability to negotiate spatial problems [30][34]. Negotiating either real or virtual navigable space, people always draw on real-world experiences and, in turn, these experiences activate situational knowledge and psychological response. Space and cognitive processes are thus inseparable.

Numerous empirical results, as demonstrated by space-syntax research – which analyses buildings and cities as systems of space rather than as aggregates of physical matter [27][28], – suggest that space is the

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common determinant of movement patterns and behavior in populated environments. Space-syntax techniques demonstrate that the nature of spatial structure itself has a determining influence on movement, land-use patterns, social and economic performance, crime patterns and pollution (analogous experiments have been attempted in VEs by [13]).

Space can be defined in several ways. Lefebvre [35] distinguishes between physical, mental, and social intertwined layers of space. Mental and social spaces are projected onto the physical space. This projection takes place when objects in the physical space are perceived as meaningful entities. Peirce [45] considers action (spatial practice expressed as social or cultural habits) as an interpreter that gives access to the meaning of an object via its sign. Social space, an accumulation of shared experiences, consists of conceived, anticipated facts and as such can be misaligned with the 'real' space. However, social space is perfectly real in that it guides our behavior. Relph [47] suggests a similar taxonomy that includes primitive, pragmatic, perceptual, existential and cognitive/abstract spaces.

Much of the existent discourse about space in VEs is to do with primitive/pragmatic and/or perceptual spaces. The former are the spaces of basic individual experiences, relatives of 'functional circles' of animals. Humans tend to resort to these foundational spaces when conscious effort is missing from their dwelling- and place-making activities; when appropriation of space occurs as a response to conditions rather than as a result of a planning process. Perceptual spaces are spaces of immediate action and, as such, carry some low-level meanings, like distances and directions. The focus on these kinds of spaces has generated a lot of interesting work on, for example, navigation in spatial environments. However, in order to relate to more complex, higher-level meaning-structures, it is interesting to turn to more inclusive definitions of space.

Perception automatically activates knowledge about visible reality [3]. This knowledge forms part of what can be described as experiential and, potentially, social space or place. The notion of place is crucial to our consciousness. It is impossible to imagine being in some uniform empty space, in 'no-place', as Proust wrote [46]: 'not knowing where I was, I could not even be sure at first who I was'. For Bachelard [4], the link between self and place was so important that he proposed a method of 'topoanalysis' defined as 'the systematic psychological study of the sites of our intimate lives'. This kind of space/place comes into existence when perceptual spaces are interconnected by cultural knowledge where understanding is common to the members of a group that shares experiences, symbols, and signs.

Created through practice and appropriation, places afford shared social setting and direct behavior. They can be contrasted with 'non-places' that define appropriation, such as typical urban car parks [2]. Place-making can be described as a process of arranging objects and spaces with the purpose of creating an environment that supports required

activities while conveying the social and cultural conceptions of the actors and their communities [7].

B. Expressive VEs

The VEs that are developed for computer games are currently among the most sophisticated graphically, functionally and expressively. The majority of current games are set in navigable space. The rich visual output and the sense of presence are among the primary appeals of such environments. However, as an emerging medium, VEs can aspire to tackle provocative, emotional, intellectual, or aesthetic issues, rather than simply generate 'presence' in its established meaning: 'the perceptual illusion of non-mediation' [36].

Jenkins [29] has suggested that game-interactions are to do with the competition for space and has argued that games tell stories by organizing spatial features. At the same time, games are criticized for their focus on spatial navigation and spatial puzzles [9] characterized by a large number of nouns (i.e. a multitude of objects) and a small verb-set (i.e. a limited number of available actions). Preoccupation with spatial reasoning is seen as detrimental to the staging of social interaction and prevents engagement with wider moral, social and aesthetic issues.

This paper argues that the role of space in VEs does not need to be (and in many cases cannot be) reduced to abstracted spatial reasoning. Even the most austere task- or rule-based VEs cannot be constructed as fully enclosed systems. The embedded design- (or game-) logic holds the spatial world together, but the way this logic is accessed and interpreted engages the user's knowledge and experience of the external world. Navigable VEs are representational: they always activate mimesis, recognition, re-enactment and interpretation, whatever the style of visual implementation or system-mechanics. The VEs are poised between systematic order (e.g. internally consistent structures such as geometry or logic) and situational order (parts of the real world can be described as systems but our world is a situation; a structure of involvements such as conditions, possibilities, necessities and freedom).

The potential of VEs is exciting because they promise to become places that are memorable and emotionally rich, places that can exude senses such as the sense of belonging and safety or, conversely, of adventure and danger. These goals can only be achieved if the user is actively engaged with the expressive dramatic potential of the experiential and social context.

3. Access to Meaning

A. Dramatic Goals

Unlike in the real world, the goal of an expressive VE is not (or not only, in the case of massive multi-player fantasy worlds) to support an existing social practice, but to provide an authored experience that poses a

challenge, illuminates a point, or entertains. The intent of the designer and the internal logic of a VE can be an expression of a particular philosophical, aesthetic, or moral standpoint.

In the real world, legibility [38] or intelligibility [27][28] of an environment is sought as a quality that is positive by default. This is particularly true in the case of authorless complex environments shaped over time by social practice (as in real-world or even ActiveWorlds [1] cities). In the real world, the spatial configuration of an architectural structure presents wayfinding problems, but is, at the same time, thought to serve as a support system that contains the information necessary for the solution [43]. Most VEs have an (collective) author and are constructed with intent. Because the users of VEs are presented with a set of tasks and motivations external to their own habitual spatial practice, the meaningfulness of VEs has to be discussed in relation to goals, agency and purpose.

Many civilizations have developed their world-views into structures of conceptual mythical spaces. Countries and civilizations have their factual and mythical geographies. It is not always easy to tell them apart, or even to say which is more important. The way people act depends on their comprehension of reality, and that comprehension, since it can never be complete, is necessarily imbued with myths [51] [52]. Massive, multi-player, online, role-playing games function, according to the participants, as communities and public spaces. These RPGs succeed in producing both public and place [42]. However, the cosmologies, creation-myths, and other world-knowledge and logic for these worlds only have a limited in-game presence (e.g. via text-, chat-, or role-dependent abilities) and need to be constructed and maintained externally, via associated web pages for example. This paper suggests that in VEs, the structure of space and events can be directly governed by such cosmologies without the need to resort to external means. As Jenkins notes [29], the designers might aim to construct, for example, Expressionist (emotion mapping onto space), Romanticist (assignment of moral values to landscape) or Surrealist (psychological symbolization of object) or other non-simulatory VEs allowing access to coherent alternative worlds. This paper proposes that the way a VE is presented and accessed should be governed by the compositional and voluntary logic (of myth, narrative, or drama), rather than by (or in some cases, in addition to) the need to express and support established, predicted, or desired social and cultural processes and requirements.

B. Narrative Potential

The term ‘narrative potential’ refers to situated affordances that can be assembled into a meaningful experience through player-actions. According to some commentators (e.g. [12] [19]), when looked at in hindsight, this experience amounts to a story. In an authored VE with expressive aspirations, it is always desirable to maximize the narrative potential and shape it in an expressive and economic way in order to provide an

agency- and meaning-dense field for interactive exploration and dramatic engagement. To achieve this, it is advantageous to create relationships between elements in ways that suggest complexity, dependencies, and hierarchies, and that generate suspense and mystery, thus constructing dramatically potent environments that are complex yet knowable: focused yet unpredictable.

C. Agency

The value of interactive access is in the agency it provides. Agency consists of intention and perceivable consequence and relies on the coherence and cognoscibility of the VE [12]. Intention is understood in terms of nested goals and plan-making in response to the game state. Agency allows users to engage in sophisticated, dynamic, exploration/planning processes that result in the construction of a mental image of the environment (with all its ingredients and events) that is active in their minds. This mental image is constructed and referred to in response to, and under the influence of, the overlapping goal- or plan-structures that the user has to construct and continuously reformulate. The ability to make inferences and interpretations in response to the situational circumstances, and thus engage in action that results in perceivable and meaningful consequence, allows users to convert the narrative potential into interconnected sequences of personal and meaningful experiences.

A common approach in game-design is to use a limited set of objects/actions and to ensure their coherent and consistent usage and meaning. This approach results in an environment in which the situational meaning of objects, derived from the real world through mimesis, is wastefully disregarded – the VE utilizes them exclusively as abstracted parts of the game mechanics. While this might be the basis of a successful game (e.g. chess in the extreme case, or Tetris [44], or even Quake [10]), such a reductive approach fails to exploit a number of meaning-layers that are either already available in, or can be brought into, the interactive environment. In a navigable VE, it is impossible to construct an ideal water-tight world of perfect internal coherence – the users will always interact with the VE on the basis of their life experiences and bring with them their own interpretations and understanding. How can a complex multi-layered VE be constructed so that multiple readings (suggested by design but referring to wider, real-world knowledge and culture) are made possible while the interdependencies between user-actions, world-events, and spaces are apparent or deducible and, at the same time, the principle of perceivable consequence is maintained? The proposed approach that guides our current practical work is to rely on the architectural design strategies for creation of meaningful places that stage, inform, and provoke exploratory, constructive, and/or imaginative user actions and to utilize a specifically arranged mediation-layer for dramatic presentation.

4. Meaning in Mind

A. Mental Image

In our physical world, the mental image of our environment ([38][23][15] the use of the term here is equivalent to the term cognitive map understood as a metaphorical device, see [32] for further references) depends on a number of parameters. We construct and perfect ‘acting in places’ in accordance with our cultural knowledge (e.g. frames of reference), personal experience and mindset, our familiarity with a given place, and also with the peculiar way that the process of knowledge-acquisition unravels (cf. different circumstances of travel: progression along a constrained route, pursuit of a guide, flâneur-like exploration or resolute navigation to a particular location). It has been suggested that map construction is a cyclic process: existing maps would shape the nature of newly constructed ones and those, in turn, would update the already established maps [49]. Mental images vary greatly depending on the information acquired through spatial travel, image-like representations, and verbal communication. Cognitive maps are never complete, accurate, survey-knowledge-like representations. They always have inbuilt distortions (e.g. [22][52]) and can be described better as mental collages [54]. Research has also shown that different people rely on different sets of outstanding situational features in order to acquire landmarks for navigation [48]. Distinct shape, function, smell, unique events, sentimental memories, or repetitive encounters can all come into play when a situated feature acquires prominence in a traveler’s mind.

Our environment is not static: we expect change and associate varying ‘speeds’ of change with different components in an environment (e.g. people transform faster than a table which, in turn, transforms ‘faster’ than walls). Our expectations are conditioned relative to these speeds. Two different people can both expect a familiar place to be there the next time they come to it, but will associate it with different opportunities and atmosphere if their encounters with the ‘fast’ layer differ significantly (e.g. if one comes on quiet mornings as opposed to during rowdy nights) (cf. [14]). Our presumptions about the meaning of an environment are always socially dependent and always refer to collective practice. The structure of the mental image transforms as familiarity with the place grows and the meaningful relationships between components become established. Using redundant elements, deduction and prediction, we can very efficiently compensate for change or inconsistencies that routinely occur in the environment. This paper suggests that the distinct personal character of mental images, their redundancy, flexibility and dynamism can be exploited when affecting user understanding, memory, and navigation.

B. Mediation Devices

A VE is a dynamic system of algorithms and data sets that are only accessible to direct experience through a layer of mediation. The

digital world exists as navigable experiential space/place only in the user's mind. The processes of learning about and appropriating space are constrained and shaped by mediation devices. The influence of these constraints can be averaged for all users at all times if the set of mediation devices is identical for all. A typical example would be a first-person-shooter game where players have points-of-view (POVs) identical relative to their avatar and the visual access, sound, lighting and effects that are identical relative to the world. These games are contests of skill and have to offer fair access to the competitors. However, even in these lapidary examples, variations are introduced when players can choose avatars of differing height or switch between the first- and third-person POVs. The first-person POV, even when enhanced by immersive stereoscopic displays with tracking systems, is not the 'correct' or even the 'best' camera choice. VR research has traditionally strived to minimize the interference of mediation devices, which makes sense for a flight-simulator. However, current technologies do not show how the mediation layer can ever become fully transparent.

If the generative role of the mediation layer is unavoidable, why not use it for place-making? Cinema demonstrates how this can be done in a multitude of powerful and versatile ways. One example is the famous Odessa Steps sequence from Eisenstein's *Potemkin* [18]. The location is the grand Classicist 136m-long, 27m-wide Steps (1837-42), built to give access to spectacular views towards the sea from the surrounding parkland, a popular place for promenades, concerts and the like. The film focuses on the axial nature of the place and transforms it into a corridor-like trap full of anxiety and danger. In the massacre scene, together with the panicking crowd, the spectator is forced to re-evaluate the place, hectically searching for ways to flee: open spaces spell danger; low retaining walls afford tiny pockets of refuge; the top end of the sloping axis is the source of threat and the fenced-in bottom is the only point of escape. This event and its dramatic portrayal reveal unexpected and shocking affordances previously dormant in this lavish structure built for the pleasure of the local bourgeoisie.



Fig. 1. The tight-shot selection throughout the sequence locks the viewer within the confines of the polarized space, in the midst of the action. In reality, the flanks are open for views and movement.



Fig. 2. The first of these shots shows, compressed, *The Steps* interpreted as a symbolically laden (high vs. low, dark vs. light, sculpture ↔ soldiers ↔ people ↔ church) axis of power and danger. The only visual connection to the ‘outside’ shows the people hopelessly searching for a refuge that this cinematically re-fabricated place does not afford.

In RT VEs, related work exists on automated cinematic cameras and automated expressive lighting [16][25][50]. Games are also becoming more sophisticated [37] in their use of in-game camera work (e.g. in *Resident Evil* [8]) and proclaim cinematic aspirations in such titles as *007 Nightfire* [20], *The Two Towers* [24] and *FIFA 2003* [17][31] in addition to the well-developed use of cut-scenes and ‘machinimas’ [33].

Our work on the *Haven* project [40][41] and observation of creative practice in computer games, suggest a number of benefits that can be achieved if the activities of the user, their spatial context, and the mediation devices are designed together with an intention to support and guide user interest. Narrative theory has suggested [5][6] that suspense, either proairetic (created by anticipating an action’s resolution) or hermeneutic (caused by unanswered questions) is the main attractor that drives the reader through a story. In VEs, the context of situated actions is one of the carriers of dramatic tension and one of the generators of suspense.

The store of mediation devices includes virtually unbounded camera positioning, shot selection, and shot sequence editing; lighting, sound-design, and special effects. Interactive events, spatial structure, and mediation devices work in unison when integrated with dramatic purposes in mind. For example, it becomes possible to reinforce or diminish the significance of an environmental feature as a landmark by associating it with some suggested socio-historical background, functionality, and unique interactive dramatic encounters and by providing dedicated lighting and camerawork that idiosyncratically depicts form, establishes scale and relationships with the other spatial elements and the avatars. The new relationships between environmental features, and their impact on mental representation, do not need to be static. As the user returns to a location to complete an action or relates to the location for navigation, an interpretation can change, creating contrast and contributing to narrative accrual.

Functional zones of architecture, thematic content-divisions, and distinct moods or styles can be arranged to align in a particular fashion to correspond with dramatic requirements. Mediation devices can establish and animate distinct emotional atmosphere in a location, delineate its boundaries, suggest genre and expected behavior. In a multi-user setting,

information and interpretations can be selectively distributed among the users, either according to their roles in the VE, their goals, the author's intentions, or users' previous actions. This strategy enables users to communicate, collaborate, and compete within the same coherent experiential field that they recognize as a shared spatial context. At the same time, purposefully arranged permanent or dynamic misalignments of users' mental images can provide rich scope for creating dramatic conflicts, encouraging collaboration, or facilitating mutual learning and social behavior.

As an illustration of the aforementioned ideas, we shall briefly consider two examples from a game with innovative camerawork and a strong theme. *Resident Evil* [8] is an RPG adventure/survival-horror title. The game mechanics are structured like a system of spatial puzzles and resource-management tasks. The game controls the camerawork and attempts to create darkly atmospheric environments consistent with the horror genre.



Fig. 3. The shot on the left is set to support navigation in this confined space and to draw attention to the functional details in the environment: the typewriter allows saving a game state, the box holds weapons and ammunition, and the ladder is the exit. These three shots also demonstrate that the game attempts to create environments with different character. However, the distinction between the rooms is usually purely visual (and sometimes supported by such effects as running water with its associated sound).

Imaginatively furnished and lit, the rooms create mysterious atmosphere but do little to support complex inferences and agency. The game relies heavily on its internal logic and repetitively uses a limited set of objects, sounds, and camera-shots to give the player signals. The plans of the environments are architecturally incongruous and even where it is possible to guess the function of a location (such as dining room or picture gallery); there is no connection to the action-potential open to the player or to the staged events.

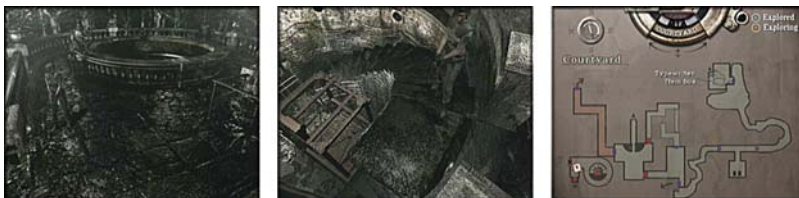


Fig. 4. The structure of the Courtyard plan is typical for the game. While the views outside the Aqua Ring suggest open space, the actual topology of the environment is a structure of labyrinthine corridors with little actual freedom for exploration. Looking at the Ring in the

garden setting, we are intrigued by the circular opening in its centre but also presuppose paths and connections to the rest of the estate that do not exist.

The spatial configuration succeeds in encouraging speculative thought that suggests rich situational structures but never utilizes them for dramatic or narrative purposes and effectively neutralizes their potential with persistent reliance on abstracted systematic interactions (some of the typical pairings signaling agency are zone ↔ activation, door ↔ passage, hoarse breathing or threatening music ↔ monster, object in frame ↔ container or button).

The examples show that some of the suggested techniques are already in use in games. This paper suggests that it is possible to strengthen their impact and provide access to a new range of expressive solutions by creating VEs that recognize the holistic nature of places and, accordingly, implement spatial structure, interactivity, and mediation in tight integration.

5. Conclusion

In an attempt to suggest how navigable RT 3D VEs can be made more expressive, meaningful, and dramatic, this paper discusses the holistic nature of spatial interactive mediated experiences. The first section considers space as an experience and suggests that meaningfulness of VEs stems from their hybrid nature that is a symbiosis of systematic and situational elements. The second section claims that this contextual meaning is only available via interactive access and is dependent on the fusion of intent and perceivable consequence: agency. The final section discusses mediation devices in RT 3D as an unavoidable layer that brings VEs into existence in the user's mind. The flexible role of the mental image is discussed and some generative opportunities are suggested. Dynamic virtual place, delivered and interpreted through purposefully arranged mediation devices, can be used for contextual placement, meaning-assignment, attention-direction, narrative time manipulations, spatial-relationship definition and development, dramatic user positioning, user characterization, interactive flow interpretation, and alterations of narrative perspective without removal of interactive access.

Limited space has not allowed detailed analysis of either the functional environments built for our research or that developed commercially. This remains a task for the future.

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