Space at Hand

Ever Nearer to HALF-LIFE

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Introduction

Design approaches for game spaces have largely been driven by a human-centered perspective. This includes approaches adapted from other media, such as film[1] or architecture.[2] Arguments would follow player-centric game design[3] or procedural media specifics.[4] Others led to the notion of a possibility space that offers players room to explore. Those arguments remain useful for many conditions, but this chapter will argue that the emergent qualities of VR spaces offer a glimpse into spatial engagement that can shift the center away from the player and to the objects they handle. Through new embodied interaction with digital objects, players can form their own sub-spaces within modern game worlds within which the role of the active object is growing. To argue for such a shift, the argument will first clarify two key concepts at work in the construction of space in games: the enacted creation of game worlds through performative action and the spatial relations that have become more prevalent through virtual reality (VR). Following this consolidation of key

1. Mark J.P. Wolf, "Inventing Space: Toward a Taxonomy of On- and Off-Screen Space in Video Games," *Film Quarterly* 51, no. 1 (1997): 11–23, https://doi.org/10.2307/1213527.
2. Michael Nitsche, *Video Game Spaces: Image, Play, and Structure in 3D Worlds* (Cambridge, MA: MIT Press, 2009).
3. Steffen Walz, *Toward a Ludic Architecture: The Space of Play and Games* (Pittsburgh, PA: ETC Press, 2010).
4. Clara Fernández-Vara, José Pablo Zagal, and Michael Mateas, "Evolution of Spatial Configurations in Videogames," *DiGRA 2005 Conference: Changing Views—Worlds in Play*.

terminology is a short breakdown of a sample case. Valve's *HλLF-LIFE* game series serves as a reference point to trace the emergence of what we might call "space-at-hand." These spaces are most visible in the VR instance of *HλLF-LIFE: Alyx* where they extend the earlier series' spatial designs. This chapter briefly looks at how space evolved from the contested space nature of the original *HλLF-LIFE* to the gradual object integration in *HλLF-LIFE 2* to the novel conditions of the VR world. Applying concepts from performance studies, these features are further discussed in reference to object performance to ultimately describe some key qualities and design opportunities of the identified design space. This should inform further discussions on the spatial design of VR worlds and their relation to earlier virtual space concepts. Central to this discussion is one particular quality of VR spaces: it is within graspable reach of the player. VR poses many design challenges, from perception to navigation, and the notion of space-at-hand is presented here as yet another one that will hopefully inform game design and criticism.

Actions in Space

Video game worlds unfold through action. As players contribute their activity and help the text evolve, as interfaces operate, as the code executes, games are enacted.[5] Action is not limited to any single component in this assembly but includes all partners involved. This has rightly been identified as a performative moment in which the elements of the game interoperate as a textual machine.[6] As a result, scholars have developed different interaction design approaches,[7] dramaturgical concepts,[8] and frameworks[9] to gameplay as performance. The technologies and research foci of such work varies widely but the central argument of an unfolding

5. Alexander Galloway, *Gaming: Essays on Algorithmic Culture* (Minneapolis: University of Minneapolis Press, 2006).
6. Espen J. Aarseth, *Cybertext: Perspectives on Ergodic Literature* (Baltimore: The John Hopkins University Press, 1977).
7. Steve Benford and Gabriella Giannachi, *Performing Mixed Reality* (Cambridge, MA: The MIT Press, 2011).
8. Rebecca Rouse, "Partners: Human and Nonhuman Performers and Interactive Narrative in Postdigital Theater," *Proceedings of ICIDS,* 2018, 369–382.
9. Clara Fernández-Vara, "Play's the Thing: A Framework to Study Videogames as Performance," *Proceedings of the 2009 DiGRA International Conference: Breaking New Ground: Innovation in Games, Play, Practice and Theory.*

performative action remains, and it serves as one tier onto which the following argument will build. Just like game play and interaction design, performance relies on action. At its core is not a prefabricated kernel but the in-the-moment construction of a performative expression; Schechner termed it an "actual."[10] At this moment, the action assembles to a shared artistic expression. Schechner's own perspective centers on the human performers, producers, and audiences, and he emphasizes the fluidity between different roles. Audience members might become performers, performers might source the underlying text, producers might turn into actors.[11] These moments of fluid construction always also include the material conditions of the surroundings, such as staging elements from lights to sounds to effects, as well as countless material items from make-up, to scenery, to props, to costumes. As will be argued below, the material agency of these non-human components in the production must be recognized as active contributions in performance and thus in performative space enaction. This changes the way we approach VR design.

The second foundation of this chapter regards challenges in human computer interaction (HCI) design that affect the spatial relations between players and digital objects in VR. As bodies are tracked in more detail and we approach full-bodied immersion in virtual worlds, players not only encounter digital landscapes or architectures anew, but they also need to deal with virtual objects and tools that have moved from the hands of their former player avatars to seemingly their own. Whether it is through motion tracking or specialized interfaces, our relations to the virtual objects in VR have expanded to a new nearness, and VR has brought digital spaces closer to us. Freundschuh and Egenhofer reviewed a wide range of spatial concepts in global information systems (GIS) to suggest six different spaces based on scale and spatial experience: "manipulable object space (smaller than the human body), non-manipulable object space (greater than the human body, but less than the size of a building), environmental space (from inside-of-building spaces to city-size spaces), geographic space (state, country, and continent-size spaces), panoramic

10. Richard Schechner, *Performance Theory* (New York: Routledge, 2003).
11. Richard Schechner, *Performance Studies: An Introduction,* 4th ed. (New York: Routledge, 2020).

space (spaces perceived via scanning the landscape), and map space."[12] Their work was central to Barba and Marroquin as they discussed a hierarchical, spatial design concept for interaction design in mixed reality (MR).[13] Freundschuh and Egenhofer had suggested three original distinctions between their six spaces: manipulability, locomotion, and size. To those, Barba and Marroquin added the role of boundaries, a form of clear separation of one space from another. Boundaries emphasize the transitioning between spaces which relativizes the role of scale. GIS and MR systems usually build on the scale of the human body and its relation to the surroundings: they might show one's position on a map, for example. Yet, this relation is optional in virtual game spaces. In VR, one could be a giant able to lift buildings or a god creature able to form whole landscapes with a sweep of one's hand. Or one might be crawling amongst the bugs of a virtual meadow. Figural here means "at hand," but the scale relationship of that hand to the given virtual world is flexible. It can change over the course of the interaction, it can be massive, microscopic, or hybrid.[14] It is the interaction design that co-defines what is figural, not the physical human body alone. With scale being so variable, the boundaries assist as a "threshold where the representation triggers different cognitive processes, conceptions of space, and associated abilities."[15] As the language of VR has not consolidated itself and the "associated abilities" are still in flux, it faces challenges across all ranges of spatial conceptions and abilities, including navigation[16] or the use of maps.[17] To tackle the boundaries between the "conceptions of space," we will focus on the transition from navigable or environmental space to panoramic and, eventually, to manipulable space. To support this theoretical argument, the text

12. Scott M. Freundschuh and Max J. Egenhofer, "Human Conceptions of Spaces: Implications for Geographic Information Systems," *Transactions in GIS* 1, no. 2 (1997): 361.
13. Evan Barba and Ramon Zamora Marroquin, "A Primer on Spatial Scale and its Application to Mixed Reality," *2017 IEEE International Symposium on Mixed and Augmented Reality (ISMAR)*, 100–110.
14. See the concept of "Worlds in Miniature" in Richard Stoakley, Matthew J. Conway, and Randy Pausch, "Virtual Reality on a WIM: Interactive Worlds in Miniature," *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 1995, 265–272.
15. Barba and Marroquin, "A Primer on Spatial Scale," 105.
16. Sibylle D. Steck and Hanspeter A. Mallot, "The Role of Global and Local Landmarks in Virtual Environment Navigation," *Presence* 9, no. 1 (2000): 69–83.
17. Weihua Dong, Tianyu Yang, Hua Liao, and Liqiu Meng, "How Does Map Use Differ in Virtual Reality and Desktop-based Environments?," *International Journal of Digital Earth* 13, no. 12 (2020): 1484–1503.

will build on a very short review of differences in spatial and interaction designs as they have emerged over the *HλLF-LIFE* series. *HλLF-LIFE* is chosen because it sidesteps the aforementioned variability of scale. In all existing canonical *HλLF-LIFE* installments, the player participates from a first-person view. The actual "size" of the virtual character might still be off (the original eye level of Gordon Freeman in *HλLF-LIFE* was 1.25 meters in the game's Hammer editor) but the player remains embodied through a relative virtual avatar in a human-like scale to the surrounding world.

Spaces of HALF-LIFE

At the time of this writing, the developer Valve's *HλLF-LIFE* series centers on three main canonical titles: *HλLF-LIFE* (1998), *HλLF-LIFE 2* (2004), and *HλLF-LIFE: Alyx* (2020), with two expansion "episodes" released for *HλLF-LIFE 2* and a range of additional mods and spin offs surrounding these core games. All three titles are critically acclaimed and have collected numerous awards throughout the years, and they play their part in the development of videogame cultures. All three titles belong to the genre of first-person shooter games and put the player into the role of a single character through whom one enacts the game space. Players see through the eyes of this character and are positioned within the game world by its virtual body. Locked into that perspective, players traverse game levels, encounter other characters, solve puzzles, and battle through countless hostile encounters. *HλLF-LIFE* takes these embodiment conditions to heart. In all three games, the unity of action, time, and space is largely left intact and no cut-scenes interrupt the unfolding events. Key elements of the gameplay involve fighting off various attacking aliens, navigating to pre-defined endpoints, interacting with non-player-characters (NPCs), and solving puzzle components.

Spatial design in the original *HλLF-LIFE* (1998) follows the "contested spaces"[18] level design. This spatial design "takes the player through a variety of atmospheres resulting in a rise and fall of dramatic tension."[19] The spatial exploration and progress through the dramatically structured environments are a substantial part of the gameplay experience. In typical first-person shooter fashion, players lack their own body but "hallucinate"[20] themselves into the game world of *HλLF-LIFE*. The game opens with the player embodying Gordon Freeman, a researcher on his way to work at an underground laboratory. Players find themselves alone on a mono-rail wagon, which descends into the mysterious Black Mesa research facility. They can navigate within the boundaries of the wagon and look around to witness activities in the facility, but they cannot influence them at this point. As a voice-over introduces the player to the facility, numerous tropes are established: the guards, the scientists, the haphazard nature of the research, the architecture. Once they leave the wagon, players will re-encounter these elements (and more) in their adventures. Except for the start-up and loading screens, the game unfolds in near temporal and spatial unity. In addition, the heads-up display is sparse. All of this further emphasizes the cohesion of the game world and the player's encounter with it. Interaction design within this encounter is largely immediate and supports a strong integration into the game world. This is reflected in the focus on an arsenal of weapons operated from a first-person point of view. Most weapons are guns that display direct impact. However, the signature weapon of *HλLF-LIFE* is the crowbar, which allows players to attack enemies at close range. This kind of design emphasizes Shneiderman's "direct manipulation" principles, formulated around the same time that *HλLF-LIFE* was developed and in the early years of HCI's emergence as its own domain.[21] Spatial interaction features continuous representation and favors physical actions over

18. Henry Jenkins and Kurt Squire, "The Art of Contested Spaces," In *Game On: The History and Culture of Video Games*, ed. Lucien King (New York: Universe, 2002), 64–75.
19. Ibid., 2
20. Olli Tapio Leino, "From Game Spaces to Playable Worlds," *Proceedings of the Philosophy of Computer Games Conference*, 2013, 2–4.
21. Ben Shneiderman, "Direct Manipulation for Comprehensible, Predictable and Controllable User Interfaces," *Proceedings of the 2nd International Conference on Intelligent User Interfaces*, 1997, 33–39.

complex syntax, "whose effect on the object of interest is immediately visible."[22] Much of this approach governs the interaction in the game, whether this regards the way we navigate our player character through the game world or how he smashes enemies with the whack of a crowbar.

The opening of *HλLF-LIFE 2* (2004) welcomes the player back in the role of Gordon Freeman to take up arms once more. Once again, they are locked in a wagon en route to a critical location, this time the larger, outdoor space of City 17. The train ride is much shorter and the introduction sequence spans into a dismal train station that sets the mood for the oppressive regime that needs to be fought. Players leave the station through a turn stall that rotates as the virtual body of the main hero presses through it. This direct contact with the turn stall foreshadows a gradual emphasis on object interaction and spatial interaction. The game's level design continues the narrative architecture principles, further emphasizing the use of vistas, dramatic structures, or atmospheres to provide a cohesive and impactful game space for the player to act in.[23] Apart from the obvious graphical update, which supported better lighting as well as texturing, much of the core design remains in place, including the crowbar. Yet, some key differences in the players' spatial relations to the world stand out. The original *HλLF-LIFE* was built on a heavily modified Quake engine that allowed for limited inclusion of physics. In contrast, *HλLF-LIFE 2* uses the Source engine, which was developed by Valve in-house and supported more advanced physics in the game world. This added a new form of agency and changed the spatial relations between player and game world. Most importantly, the physics integration allowed for the new signature weapon of *HλLF-LIFE 2*: the Zero Point Energy Field Manipulator, or Gravity Gun. The Gravity Gun allowed players to pick up objects with the help of the gun mechanics and drop them onto other objects in the game world. Operating the Gravity Gun remains indebted to the principles of "direct manipulation," but its effects establish forces-within-forces of control. Instead of the immediate impact or collision control, the objects can gain a limited agency thanks to the better physics

22. Ibid., 33.

23. Teun Dubbelman, "Designing Stories: Practices of Narrative in 3D Computer Games," *Proceedings of the 2011 ACM SIGGRAPH Symposium on Video Games*, 37–41.

system. This is visible in the ragdoll physics of defeated soldiers tumbling down as much as it is in the flight paths of saw blades propelled by the Gravity Gun to cut through enemy limbs. Objects show effects onto other objects within the game world. This affects not only the player as an actor within the game world but also the bodies of the enemies, the saw blades, the containers, the energy cells, or whatever other object one picks up with the Gravity Gun. The Gravity Gun is instrumental in the final fight of the game, where only the objects of the antagonists are strong enough to destroy their doomsday machine. There are traces of agency in objects that do not rely on Artificial Intelligence but find their logic in relation to other objects in the virtual world, and players start to enact these objects. This agency is still limited and the player's engagement with them remains simplified. For example, collecting items such as ammunition from the ground is done by simply running over them, as was the case in the original HλLF-LIFE. Likewise, using the Gravity Gun still mimics the same basic operations of any other gun in the game and neither direct hand input nor other gestures are implemented.

HλLF-LIFE: Alyx (2020) continues many of the elements that were established in the earlier titles. This includes basic physics as part of the game world, first-person-only representation, continuity in space and time, and highly evocative dramatic level design. It opens with the player taking on the role of Alyx Vance, alone on a balcony overlooking an earlier version of the outskirts of City 17, a sprawling urban space occupied by the already established alien antagonistic force. It further emphasizes connections to the past games in its story—which works as a prequel to *HλLF-LIFE 2*'s events—experienced through the eyes of one of the secondary characters of that older title. As expected, the underlying engine, Source 2, provides updates for AI, graphics, and physics simulations, among other features. But the most significant shift is that *HλLF-LIFE: Alyx* is designed from the ground up as a VR-game. Its entire design was optimized for a VR experience. In the opening scene, the player finds themselves in the virtual body of Alyx and, through motion tracking, they can manipulate a radio nearby, grab the railing and lean over the balcony, pick up objects and use them, and affect the game space through their hand and body motions. Spatial navigation is performed either through

button controls or via teleporting, which changes the spatial experience of the game world significantly. Neither the crowbar nor the Gravity Gun are available in *HλLF-LIFE: Alyx*. Instead, it features two new signature interaction devices. The first is a pair of Gravity Gloves, reminders of the Gravity Gun's functionality, which allow the heroine to lift large objects and evoke a force to pull any distant object towards them (see image 6.1 right). The second is the Multi-tool, a scanning and hacking gizmo (see image 6.1 left), which Alyx already used as a non-player-character in *HλLF-LIFE 2* to overcome obstacles through technical overrides. Now, it is under the control of the player, next to guns and grenades. Both allow for more direct object manipulation akin to puppetry and object performance, as this chapter will argue.

Image 6.1. *HλLF-LIFE: Alyx: Aligning beams in space (left) and solving a globe puzzle (right).*

These new interaction options are not just software-based: Valve released its own VR system, which includes the Valve Index controllers. These hardware input devices are tracked in space like other VR input devices, such as the HTC Vive controllers. They also include their own set of buttons, thumbstick, and capacitive touch to control movements, trigger actions, or sense other input. But in addition to these features, the Valve Index controller incorporates muscle sensors that track finger activity. The controllers are strapped to the player's hands to actively track the muscles on top of one's hands. Overall, they integrate a combination of motion sensing, button input, and muscle tracking. Players can trigger actions using buttons that might be associated with a tangible representation (as it is in the case of the gun trigger that is mirrored on the control device as a trigger button), control more abstract interaction designs (as it is in the case of spatial navigation using the joystick as input), control position and orientation through the tracked movement of the hand

in space (one aims or reaches in that way), and use the movement and muscle tracking options. This last option is key to the use of the Gravity Gloves. One points at an object in the distance, forces that object towards the player character by flicking the wrist, catches it by closing one's hand, and stores it into one's virtual backpack by throwing it over one's shoulder. Picking up game objects with the gravity glove is an embodied interaction that requires some effort, and this effort transcends into the role of the objects. *HλLF-LIFE: Alyx* can be played with other VR controllers, but this combined interaction design of novel hardware and innovative gameplay opens up a new spatial condition for the game series. Technically, players gain access to a space that is literally at their hands, and the game design actively supports the activation of this space. These spaces were only rudimentary in the first two titles, insofar as one could hit nearby obstacles or enemies with the crowbar and destroy them. Now, the use of this space-at-hand allows activation of objects within the world, of objects "at our hands." It shifts the spatial center closer to the hand and enriches the vocabulary of the nearby object's agency. It is an additive effect across the spatial scaling outlined by Freundschuh and Egenhofer. If the players read the environment as navigable dramatic space in *HλLF-LIFE* and further accept the operation of objects onto other objects in *HλLF-LIFE 2*, then the space-at-hand in *HλLF-LIFE: Alyx* brought controls ever closer to the embodiment to the player. This affects the first two concepts along the way. Players now can touch and explore the larger spaces through this closer one, understand them through the new lens, and read them as future spaces-at-hand. An alien tower looming in the distance is not only a visual landmark but a possible surface to be touched and examined. Its walls are not limited to collision barriers anymore, but they might include power cables that can be scanned and manipulated with the Multi-tool. Enriching the level of detail in the manipulable space establishes a new spatial agency in the game world. It also establishes new expectations, which can trigger a different perception of the overall game space and affect the experience throughout. The following section will trace the components of these new qualities for the performative nature of game worlds.

Object Performance in HALF-LIFE: Alyx

The novel interaction design of *HλLF-LIFE: Alyx* invites players to realize individual objects and their roles within the game spaces in ever more detail. Instead of an upscaling to a vast, open-world playground, this is a scaling up of detail in close quarters. It activates the spaces-at-our-hands and with this, it enhances the agency of the objects that operate in this closeness. We oscillate between what Heidegger termed "present-at-hand" and "ready-at-hand" as digital objects simulate a "handiness" (or Zuhandenheit) in which the thing's being "reveals itself by itself."[24] The performed space is renegotiated, and the digital objects manage to find their own agency within the game world, which is where the argument somewhat departs from the focus on handiness. Just as the game levels' architectures unfold following their own dramaturgy, so do the smaller objects at the scale of the players' hands. As objects gain more operations in the space-at-hand, interaction turns into critical object manipulation. In that way, spaces-at-hand are constructed through means of "material performance:" "At its simplest, this term assumes that puppets and other material objects in performance bear visual and kinetic meanings that operate independently of whatever meanings we may inscribe upon them in performance."[25] In these cases, the object does not center on optimized functionality but includes constant, individual "operations" that need to be renegotiated. Material performance allows the seemingly inert object to provide its own quality to the unfolding events. On the other end of the spectrum, this relates to approaches in new materialism that argue for "material agency,"[26] which sees objects as participants in the unfolding activity as much as humans.

In their current stage, the object performances in *HλLF-LIFE: Alyx* are still limited. They often manifest as puzzles with predefined end-states. These include disarming a tripmine, opening a container, or solving a wiring puzzle. Many of the more complex manipulable objects (a rotating globe,

24. Martin Heidegger, *Being and Time*, ed. J. Macquarrie and E. Robinson (London: SCM Press, 1962), 69.
25. Dassia N. Posner, Claudia Orenstein, and John Bell, eds. *Routledge Companion to Puppetry and Material Performance* (Florence, KY: Routledge, 2014), 5.
26. Jane Bennett, *Vibrant Matter: A Political Ecology of Things* (Durham: Duke University Press, 2010).

a globe with implemented obstacles, a virtual buzz wire game) are digital versions of existing tangible toys, and their logic is immediately accessible. Players might trace embedded virtual wirings in the walls of a game world segment, rotate light globes to navigate points over their surface, guide targets through a kind of mini obstacle course, or arrange beams within a 3D configuration. The variation of one's performance of these spaces is limited to finding the right solution to the given puzzle. Still, in the players' explorations of the object set ups and operations we find an activation of the virtual object through hand gestures. If the puzzle pieces are deliberate in their set up, the Gravity Gloves are much more open in their activation of in-game objects. They allow players to pull countless objects toward them, catch them, break them, throw them, or drop them in a kind of virtual jugglery. Even without the glove gadgets, players can pick up objects, push buttons, open doors, manipulate machinery, pick up markers, write on surfaces, and affect numerous objects within the game space. They actively perform the space-at-hand just as they had done with the larger-scoped spaces introduced in *HλLF-LIFE* and *HλLF-LIFE 2*. The closest performative relative to this kind of object manipulation is puppetry.

Puppeteers are used to relinquish control and commit to a constant dialogue with the puppet: "the puppeteer is playing with a certain lack of control, and experimenting with the different possibilities of the puppet while constantly being aware of how the puppet's structure determines movement."[27] The performer recognizes the material agency of the originally inanimate object and its significance for the unfolding performance. Mind you, the materiality of objects in *HλLF-LIFE: Alyx* is still limited. The puzzles consist mostly of ephemeral light projections, but they are still moved, aligned, rotated, grabbed, and manipulated much like puppet objects. Through these enacting performances, the objects gain their own agency through a kind of constant renegotiation. A "material agency" is being constructed as they are part of the gameplay enaction: "The essence of puppet, mask, and object performance (as countless pup-

27. John Bell, *American Puppet Modernism: Essays on the Material World in Performance* (New York: Palgrave Macmillan, 2008), 7.

peteers have said from their own experience) is not mastery of the material world but a constant negotiation back and forth with it."[28] One's own role as active player-actor is being enforced as much as the contribution of the material object in correspondence. Space-at-hand does the same for VR design. What was discussed as "environmental presence"[29] in HCI and game studies merges with a notion of "co-presence," namely a kind of being-there-together of human and virtual objects. So far, these effects were largely applied to social co-presence,[30] but the role of active objects that we spatially perform in spaces-at-hand extends this notion to the virtual objects and their materials. It is not only the other player who is realized but also the object in one's vicinity. In that way, agency finds a new level of detail in VR.

VR Object Spaces

Ultimately, the argument arrives at a design space for spaces-at-hand. It sketched out the evolution of this condition and introduced new materialism and object performance as theoretical references. There are two main threads to this argument. The first regards the expansion of space as a "closing in on the player." As the brief discussion of the *HλLF-LIFE* game series showed, its spatial design supports an increasing level of detail for object manipulation. This applies especially to the installment of *HλLF-LIFE: Alyx*. The new closeness and relation to the digital object operates through the dual effect of increasing embodiment and enhancing the agency of virtual objects. It is in the interplay of new object agency and the enacting hand that touches and manipulates in which new forms of interaction emerge. This leads to increased individual agency available to these objects through a form of digital puppetry, which presents the second core argument. With it, we can connect the

28. John Bell, "Playing with the Eternal Uncanny: The Persistent Life of Lifeless Objects," in *The Routledge Companion to Puppetry and Material Performance*, ed. Dassia N. Posner, Claudia Orenstein, and John Bell (Florence, KY: Routledge, 2014), 50.
29. Carrie Heeter, "Being There: The Subjective Experience of Presence," *Presence: Teleoperators and Virtual Environments* 1, no. 2 (1992): 262–271.
30. See Jari Takatalo, Jukka Häkkinen, Jeppe Komulainen, Heikki Särkelä, and Göte Nyman, "Involvement and Presence in Digital Gaming," *Proceedings of the 4th Nordic Conference on Human-computer Interaction: Changing Roles*, 2006, 393–396.

enactment of such spaces-at-hand to object-related performance practices. Interaction design, here, should be read as material or object performances, keeping in line with the notion that all spaces in video games are ultimately performed, but some are just closer to the hand than others. Such closeness in performance and manipulation provides the next addendum to the expanding natures of game spaces. As such, it offers its own qualities and reflections. As Bell notes for traditional puppetry, "our playing with objects allows us to come to terms with death."[31] If new materialism offers a theoretical lens to change human-object relations, then puppetry and manipulable spaces-at-hand provide the practical design arenas to explore them in VR games. That does not make designing for VR easier, but hopefully more meaningful.

31. Bell, *American Puppet Modernism*, 5.

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