In 1987, brothers Rand and Robyn Miller formed the company Cyan (which was briefly known as “Prolog,” the name of Rand Miller’s consulting company)\(^1\) and began working on their first program, *The Manhole* (1987), one of the first entertainment products to appear on CD-ROM. *The Manhole* was a software program for children, made in black and white for the Macintosh, with a point-and-click graphical user interface, which involved exploration and navigation through a fanciful underground world inhabited by talking animal characters that the player encountered along the way. Cyan’s next two programs were also for children, *Cosmic Osmo and the Worlds Beyond the Mackerel* (1989), which featured the exploration of seven interconnected small worlds, and *Spelunx and the Caves of Mr. Seudo* (1991), whose underground cave system contained a number of educationally oriented games, in which the player could learn about such things as Cartesian coordinates, the growth of trees, and also, according to D’ni historian and longtime Cyan employee Richard A. Watson’s (RAWA) website, “study metabolism by changing the environment of a pet lizard, learn properties of light and sound with the lightning simulator, experiment with gravity by dropping pebbles in the Yon-Yon Caverns, watch the Criss-Ants as they search for food and take it back home, and many other activities. The cave system is also modular, so it is possible that if new rooms are discovered in the future, they can be added to your cave.”\(^2\)

The games were all released on the new medium of the CD-ROM, although other versions were available; *Cosmic Osmo*, for example, was released on six 3½-inch floppy diskettes through Activision. *The Manhole*
and *Cosmic Osmo* were both relatively small programs, much less than the roughly 650 megabytes available on the CD-ROM, and both games used the remaining space on the CD-ROM for songs used as the soundtrack for the games, giving them a soundtrack superior to the rather thin electronic music found in many other games of the era. Like other computer-based adventure games of the time, the original black-and-white games were revised and rereleased; a redone version of *The Manhole* with color and higher-resolution graphics appeared as *The Manhole Masterpiece Edition* in 1994, and a colorized version of *Spelunx* appeared in 1993. A “Version 1.2” of *Cosmic Osmo* was released, and a colorized version was started but never completed. Myst itself would undergo revision and rerelease, appearing with enhanced graphics and sound and a “DigitalGuide” hints feature as *Myst Masterpiece Edition* in 1999, and as the real-time three-dimensional version, *realMyst*, in 2000, for which new models of everything were generated using the original Myst models for reference.

The underground worlds of *The Manhole* and *Spelunx*, as well as the underground areas found in the *Myst* series, hark back to the original underground adventure of Will Crowther’s caving program, recalling the roots of the adventure genre. The idea of an underground world would eventually result in the subterranean civilization of the D’ni, whose caverns are the centerpiece of the Myst series’ world. *The Manhole* also traces its roots to Lewis Carroll’s *Alice in Wonderland*, and both the book and the White Rabbit make an appearance in the game, and even the name “Manhole” alludes to the rabbit hole into which Alice falls. On a bookshelf (every game designed by the Miller brothers has a bookshelf in it somewhere) in *The Manhole* there are other children’s classics whose influence on the game’s design is apparent: A. A. Milne’s *Winnie the Pooh*, Kenneth Grahame’s *The Wind in the Willows*, and C. S. Lewis’s *The Lion, the Witch, and the Wardrobe*. Each book, when opened and clicked on by the player, also becomes a portal of entry into the world of *The Manhole*, prefiguring the D’ni linking books long before the appearance of *Myst* (another early version of a linking book appears in *Cosmic Osmo*).

Like *Myst*, all three of the early games used a point-and-click interface, with all the necessary informational graphics worked into the diegesis of the game itself. Even the little hand-shaped cursor (which replaces the computer’s arrow cursor) is included in some of the animations in *Cosmic Osmo*. In one, the cursor gets eaten by the pumpkin-head after the player clicks on it, and in another, the hand flies around in pain and plunges into
water after the player clicks on a hot surface, which the player is likely to do since a nearby sign warns the player not to touch it.

There are many other stylistic similarities between the three early games and Myst. Common elements among all the games include ladders and stairways (the ends of which extend invitingly out of holes, shafts, and doorways; see fig. 4); messages on sheets of paper left in mailboxes, drawers or other places; lights that the player turns on and off; views looking out of windshields from inside vehicles as they travel; elevators (usually with a window to give some sense of movement, similar to the windshields); underground rock-walled mine tunnels hung with lightbulbs (occasionally including mine cars on tracks); and in both The Manhole and Myst, an old, wooden sunken ship (which is not used for travel, but rather as an environment just like a building), as well as little vehicles that can travel between a small number of fixed destinations. Exploration and navigation are central to all the Miller brothers’ games, and they are the only real objectives in the three early games. The additional objectives found in Myst, Riven, and later
games in the *Myst* series act as motivation for the player’s discoveries, placing an even greater importance on exploration and navigation.

Experimentation is often linked with exploration (and is, in a sense, an extension of it into the realm of the known versus unknown), and laboratories and rooms of simple machinery also populate the worlds of the Miller brothers’ games. Media technology figures prominently: books, phones, video screens (or the moving images found within linking books), imagers, and radar-like screens that track a vehicle’s progress. *Cosmic Osmo* even self-reflexively includes two video games, *Ship Chip Lander* and *RubberGut*, and even a Macintosh computer displaying *Cosmic Osmo* itself (see fig. 5). While playing either of the two games after depositing a quarter (several of which are conveniently located on the game cabinets), players are reminded how far the video game has come from the one-screen games of simple action, and how advanced *Cosmic Osmo* is by comparison. Oddly enough, however, when one clicks on the Macintosh with *Cosmic Osmo* displayed on-screen, one does not get to play it (it would have been a nice example of recursion if the player’s clicking on the computer would have returned the player to the title screen and restarted the game, only to jump back out later when the player tries to quit).

Optical technologies are another theme in the content of the Miller brothers’ worlds. Telescopes appear in *Cosmic Osmo*, *Spelunx*, *Myst*, *Riven*, and *Myst III: Exile*, each for a different purpose (*Myst* has telescopes in both the Stoneship Age and Mechanical Age); *Cosmic Osmo* has a microscope with a number of different slides at which the player can look; *Myst* and *Riven* both have imaging devices, and *Riven* in particular connects locations with cameras and viewscreens, sometimes tantalizingly. *Riven* also has its phenakistiscope-like viewers through which the player can view and align the symbols on the rotating domes, and *Myst III: Exile* has other technologies including reflectors used to bounce a beam of light across the island, viewscreens, and more. The idea of mediated imagery is present not only within the games’ diegeses, but in the games’ images themselves; for example, lens flares are present in images in both *The Manhole Masterpiece Edition* and *Myst*. Lens flares are an element of photorealism, not realism; such images attempt to imitate mediated images rather than direct experience. Because the worlds of the *Myst* series are all themselves entirely constructed from mediated imagery (or purportedly mediated imagery, since the imagery is computer-generated and not photographic in origin, except
Fig. 5. Video games within the world of Cosmic Osmo: Ship Chip Lander (top), and the close-up of its screen (center); and Cosmic Osmo itself (bottom)
for the textures and video clips), the mediated imagery within the game adds another layer of mediation whereby the game imagery itself (which is made to seem less mediated than the diegetic mediated imagery) gains a more realistic feel as a result.

Even without the optical technologies present, players are able to see farther (spatially) in these games than in others of the time. One of the graphical design advances in *Myst* that can be seen developing in the early games is the ability to view other areas of the game’s world before arriving at them. In most video games of the early 1980s and before, spaces either scrolled on and off the screen, or cut scene to scene or room to room, with the player able to view only one space at a time, the space they currently occupied (see figs. 2 and 3 for examples). *Myst*’s diegesis gained a degree of realism by integrating its locations in more three-dimensional deep-space staging in which players could see distant areas long before they arrived there. The clock tower, spaceship, and library are all examples of locations that can be seen at a distance, requiring the player to click and move several times in order to get to them, depending on where the player is located. Examples of deep-space staging can be found in the Miller brothers’ earlier games, although the most distant objects visible are never more than two or three moves away.

Deep-space staging was an important advancement for the adventure genre because it encouraged exploration by giving glimpses of spaces the player had not yet entered, and aided navigation by giving a visual sense of the three-dimensional geography of the game’s world. While deep-space staging existed in earlier video games like *Night Driver* (1976), *Battlezone* (1980), *Pole Position* (1982), and *Star Wars* (1983), it was only used to allow players to see oncoming obstacles or adversaries, whereas in the Miller brothers’ games it was used to create contiguity and to entice players into other areas.

The development of space in the Miller brothers’ games occurs aurally as well as visually. Locations are given specific background ambiances, and sound effects are used to suggest events occurring nearby off-screen. Linking ambient sounds with particular locations was a new idea in the late 1980s; most video game soundtracks consisted of background music that played regardless of the player’s location, and short sound effects motivated by game events. While ambient sounds in the Miller brothers’ early games cut off abruptly once the player left an area, ambient sounds in *Myst* would grow or die out gradually as the player moved from one location to another.
For example, near the dock on Myst Island the quiet cry of seagulls and the lapping of the waves provides a calming, lulling ambience, but as the player moves up the hillside towards the library and the island interior the seaside ambience grows fainter and then is replaced by the quiet sound of the wind. Certain enclosed locations, like the bedrooms or the underground chamber near the dock, even had ambient music that could be heard faintly as one approached the room.

As in film and television, sounds of off-screen events also help to create the sense of a surrounding space where events continue to happen even though the viewer or player is no longer there. In Cosmic Osmo, for example, when the player drops the carrot off-screen down into the room in which Señor Osmollo is encountered, we hear the sound of it hitting him on the head, and then the sound of him eating it. Or in the test tube lab, when the player drops a test tube off-screen, we hear the crash as it shatters on the floor (eliminating the need for an on-screen animation of the event as well). In Myst, sounds of off-screen events gained importance as clues. The metallic clanking of the tower rotation, the bubbling water sound of the sunken ship being raised, and the periodic *ka-thunk* of the tree elevator going up or down all occur initially as off-screen sounds that the player must investigate.

Another idea developed particularly in Cosmic Osmo and Myst is that of distant consequences arising from the player’s actions. In Cosmic Osmo, whatever the player draws on the canvas set up on the easel inside the Vegetable Moon will later appear on the canvas hanging in Osmo’s den inside the Holy Mackeral. Likewise, the programming the player sets at the KSMO station will later appear on Osmo’s handheld television and the TV window on the Macintosh, and the message on an animated text display can be rewritten by the player elsewhere in the game. While none of these things is necessary for the playing of the game, since there is no real objective or goal, Myst used the separation of action and consequence to much greater effect, requiring players to figure out how to power and operate machinery or gain access to certain restricted areas. In Cosmic Osmo, all of the technology encountered has a clear purpose, which most often is simply an entertaining bit of animation and sound effects. Myst, on the other hand, often features buttons, levers, and the like, which appear to do nothing at all when activated, offering neither entertainment nor useful, obvious functionality. Such apparent uselessness, however, often does effectively create an enigma, giving the player a mystery to solve and a mini-objective to pursue.
A device developed in *Cosmic Osmo* that would be used to greater effect in *Riven* is the idea of differing results given in response to a repeated action. Clicking on a character more than once or visiting the same location more than once can reveal new responses or information. In *Cosmic Osmo*, Princess Osmorella gives several different responses from her throne each time the player visits her. If the winding stairs are taken, she will be gone from the throne the next time the player comes to the throne room, and in her place a secret entrance is revealed. Likewise the slide fixer under the amoeba gives different responses the first and second time the player clicks on him, and ignores the player beyond that. In *Riven*, knocking five times at the door of the village hut brings an answer from a little girl, who opens a window, looks out, and shuts the window, giving no response to the player after that. And in Gehn’s underwater control room, knocking on the window will provoke a series of responses from the wahrk swimming nearby, until it, too, ignores the player.

While there are many similarities between the Miller brothers’ three early games and the games of the *Myst* series, there are some striking differences. In some ways, the design of the early games represents a road less traveled, as opposed to the heavily trodden thoroughfare that the *Myst* series and most other video games have taken. As children’s fare, they could afford to be more lighthearted, whimsical, and downright silly, but certain aspects of the games could have been parlayed into more serious games for an older audience.

Perhaps the most noticeable difference is the games’ wildly non-Euclidean structuring of space. Whereas *Myst*, *Riven*, and most other games attempt to convey a sense of a coherent three-dimensional space in order to give their worlds a feeling of spatial consistency and believability, *The Manhole*, *Cosmic Osmo*, and *Spelunx* are playfully inconsistent in the way space is constructed and connected, and navigation can only be done by experience, since there is no way to predict the way in which one space will be connected to another. Even the effects of gravity can be ignored (see fig. 6). For example, in *Cosmic Osmo*, one can get from one planet to the other either by flying in the Osmobile (which does not give any sense of distance or direction, since flights always end with the windshield filling with animated concentric ovals), or by wandering through the rooms, stairways, and imagery of the game; by looking through the telescope on Vegetable Moon, one sees the Mackeral in space, which one can then arrive at by click-
ing on it (the same can be done with the objects in the microscope). In Spelunx, an entire forest can be found by entering a door in a teapot, and in The Manhole, one can ride in a boat in a teacup (tea and the crockery associated with it are another indirect allusion to Carroll’s very British Alice in Wonderland). In Myst and Riven, consistent geography and an understanding of how it is related to the maps of the islands are crucial to the puzzle-solving in the games. For example, in Myst the rotating of the tower to align a window with various landmarks on Myst Island is necessary to gain the key clues to each of the Ages, and in Riven, Survey Island (or Map island, as it is sometimes called) requires the player to have an understanding of the five islands and how they are related geographically.

Another device (also reminiscent of Alice in Wonderland) that defies spatial consistency is the changing of the perspective and implied size of
the spectator. Three examples of this from *Cosmic Osmo* are illustrated in figure 7. The left-hand picture of each pair is drawn from a perspective closer to that of what a normal-sized human being would see, whereas the right-hand pictures show the perspective of someone standing only a few inches off the ground. Each pair of pictures occurs one after the other in the game with no explanation or even acknowledgment of the apparent shift in size of the spectator (in the top left-hand picture the perspective seems already smaller than an ordinary human, and the right-hand one is smaller.
still). The player appears at times to be a full-sized human, yet is able to go into tiny doors, into the little submarine that appears in a bathtub, or even down the sink drain in the kitchen. Unlike *Alice in Wonderland*, there is no moment when the player actually changes size, or is given the means (like the “Drink Me” bottle in Carroll’s story) of effecting a change.

In *Myst* and *Riven*, on the other hand, the scale of the implied spectator remains fairly consistent throughout, especially in *Riven*, where a “virtual stuntman” known as “Harold” was used to regulate perspective. According to Richard Kadrey,

> To compensate for the fact that in designing shots separately, often by separate artists, the scale of the surroundings might be different from one view to the next, a virtual stand-in—a six-foot tall computer-generated dummy—was employed. This non-union guinea pig was perfect for dropping into scenes to make sure that all the props and sets were in proper scale and that the eye line the artists were using for the scene matched with the eye line from the previous scene. It would be pretty jarring to see the world from six feet off the ground in a hallway and suddenly find yourself eight or ten feet in the air after entering a room.

Changes in perspective, if part of the game’s conceit, are not necessarily always “jarring,” and they are certainly part of the charm of *Cosmic Osmo’s* playfulness and whimsy. In a game for adults, such changes could be integrated into the puzzles themselves, where players could be required to find and use the means needed to change themselves to the appropriate size in order to enter tiny spaces, reach high objects, or perform other kinds of tasks. The same environments could be experienced in different sizes, with puzzles of different scales interwoven together.

Another factor in the greater spatial consistency of *Myst* and *Riven* is the use of computer-generated objects and scenery. Whereas hand-drawn images are typically drawn separately, multiple views of an object or scene can easily be generated from the same three-dimensional computer-generated models, ensuring that perspective, lighting, texture, and geometry remains consistent from one image to the next. Consider, for example the three different views of the microscope from *Cosmic Osmo* in figure 8.

In the first image, the rack of slides is positioned alongside the microscope so that its sides are parallel to the base of the microscope. In the second image, the position of the rack has shifted so that the space between the rack and the microscope narrows in the direction of the door. In the third
Fig. 8. Spatial inconsistencies between views in *Cosmic Osmo*
image, the rack does not even appear in the frame, despite the amount of space provided to the left of the microscope. In both the first and second images, the slide rack appears to be casting two shadows, a darker one near the rack and a wider one extending out farther, yet there does not appear to be two light sources (which would have to be located on the same side of the ceiling to produce the overlapping shadows). Such inconsistencies, whether they are inadvertent or deliberate “cheats” done for aesthetic reasons, can also be done with computer-generated objects, but hand-drawn images do not generate the same kind of expectations of consistency that computer-generated objects do. Part of the reason is the ontological status of the objects; whereas views of hand-drawn objects are drawn individually by the artist, views of computer-generated objects are calculated mathematically from a three-dimensional model in the computer’s memory. Thus when we do not see a part of the hand-drawn object, we know it is not there, whereas the occluded portion of the computer-generated model still exists as data even when it is not displayed on-screen. The objects of Myst and Riven, then, have a different ontological status than the hand-drawn objects of the earlier games, resulting in different player expectations and a different feel to their worlds.

The Miller brothers’ games also represent other ideas regarding navigation. With fewer places to go but more connectivity between them, the early games were more playful with the consistency of their worlds and less concerned with verisimilitude. Using the computer’s internal calendar and clock, Cosmic Osmo even included the current time and date on displays in various rooms, an intrusion of the real world beyond the game that would not be allowed in the games of the Myst series. By comparing the Myst games with the three earlier ones, we can better appreciate the decisions made regarding the direction Myst was to take, and the crafting of the player’s experience of the game and the world in which it takes place.