

Somewhere Nearby is Colossal Cave: Examining Will Crowther's Original “Adventure” in Code and in Kentucky

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Revision Note

This article has been revised since its original publication. A link to an audio file in Figure 36 has been moved into a note. The previous version of the article will remain available.

Abstract

Because so little primary historical work has been done on the classic text computer game “Colossal Cave Adventure”, academic and popular references to it frequently perpetuate inaccuracies. “Adventure” was the first in a series of text-based games (“interactive fiction”) that emphasize exploring, puzzles, and story, typically in a fantasy setting; these games had a significant cultural impact in the late 1970s and a significant commercial presence in the early 1980s. Will Crowther based his program on a real cave in Kentucky; Don Woods expanded this version significantly. The expanded work has been examined as an occasion for narrative encounters [Buckles 1985] and as an aesthetic masterpiece of logic and utility [Knuth 1998]; however, previous attempts to assess the significance of “Adventure” remain incomplete without access to Crowther's original source code and Crowther's original source cave. Accordingly, this paper analyzes previously unpublished files recovered from a backup of Woods's student account at Stanford, and documents an excursion to the real Colossal Cave in Kentucky in 2005. In addition, new interviews with Crowther, Woods, and their associates (particularly members of Crowther's family) provide new insights on the precise nature of Woods's significant contributions. Real locations in the cave and several artifacts (such as an iron rod and an axe head) correspond to their representation in Crowther's version; however, by May of 1977, Woods had expanded the game to include numerous locations that he invented, along with significant technical innovations (such as scorekeeping and a player inventory). Sources that incorrectly date Crowther's original to 1972 or 1974, or that identify it as a cartographic data file with no game or fantasy elements, are sourced thinly if at all. The new evidence establishes that Crowther wrote the game during the 1975-76 academic year and probably abandoned it in early 1976. The original game employed magic, humor, simple combat, and basic puzzles, all of which Woods greatly expanded. While Crowther remained largely faithful to the geography of the real cave, his original did introduce subtle changes to the environment in order to improve the gameplay.

Introduction

Will Crowther's “Colossal Cave Adventure” was neither the first computer game nor the first program to emulate conversation^[1]; nevertheless, “Adventure” — an interactive textual simulation of a caving expedition, augmented by fantasy-themed puzzles — inspired a generation of hackers. Playing “Adventure” involves reading prose descriptions of the setting, and typing brief commands (i.e. “light lamp”) in order to solve puzzles and collect treasure. Similar text games representing environments defined both by story and rules were extremely popular during the 80s and (with the addition of graphics) through the 90s. Text-adventures, also known as “interactive fiction” (IF),^[2] attracted modest scholarly attention as an emerging literary form in the 80s,^[3] yet “[m]ost commentators and critics of the adventure game genre... fail to mention the original *Adventure* at all, and those who do usually date it far off the mark... and often

neglect to mention its creators” [Aarseth 1997, 107]. The resulting vacuum has attracted memes, some so firmly lodged in our inventory of digital lore that they regularly appear without citation. In order to map out the groundwork for a more accurate assessment of “Adventure”, its innovations, and its legacy, this study draws on two crucial resources previously unexamined by digital scholars: Crowther’s original source code and Kentucky’s original source cave.

Levy observes that “like any significant program, Adventure was expressive of the personality and environment of the authors” [Levy 1984, 133]. Due to Crowther’s personal choice to keep a low profile,^[4] analysis of “Adventure” ^[5] must rely more heavily on the environment — both professional and natural. We know Crowther’s coding environment was collaborative and highly technical,^[6] but so far we have only known Crowther’s “Adventure” indirectly, through a version greatly expanded by Don Woods. Section 2 of this article is a formal examination of Crowther’s original source code files, offering, for the first time, a clear understanding of Crowther’s innovative blend of simulation and fantasy, as well as a better appreciation of the creative contributions of Woods. Section 3 compares the game to maps of the cave site, presents photographs of an excursion to Colossal Cave, and offers testimony from experienced cavers. These key sources — the code and the cave, analyzed here for the first time — establish that Crowther’s original was not only faithful to the geography of the real Colossal Cave, but was also a fantasy remediation of that site. Section 4 offers a revision of the “Adventure” timeline in an attempt to correct common misconceptions and encourage further scholarship, and a brief conclusion compiles the major formalist observations, as a gesture towards encouraging further research.

Taking Inventory of “Adventure”

While today’s young computer professionals may have only passing familiarity with “Adventure”, the game had a tremendous effect on an earlier generation of programmers. Lines from “Adventure”, such as “You are in a maze of twisty little passages, all alike” and the magic word “XYZZY”, quickly entered hacker culture. *The New Hacker Dictionary* ^[7] includes the term “vadding” (“from VAD, a permutation of ADV (i.e., ADVENT), used to avoid a particular admin’s continual search-and-destroy sweeps for the game”), defining it as a “leisure-time activity of certain hackers involving the covert exploration of the ‘secret’ parts of large buildings” [Raymond 1996, 465].



Figure 1. Tourist Caves as Graphical User Interface. In a tourist cave, clean and orderly routes shunt visitors along carefully defined paths that emphasize visual impact. Some sites offer access ramps, elevators, and conveniences such as underground bathrooms, carefully isolating visitors from the potential for uncertainty or discomfort. The managed environment serves non-specialists who are unlikely to explore undeveloped caves. Photo illustration by Dennis G. Jerz, © Cave Research Foundation 2005. Reproduced by permission.

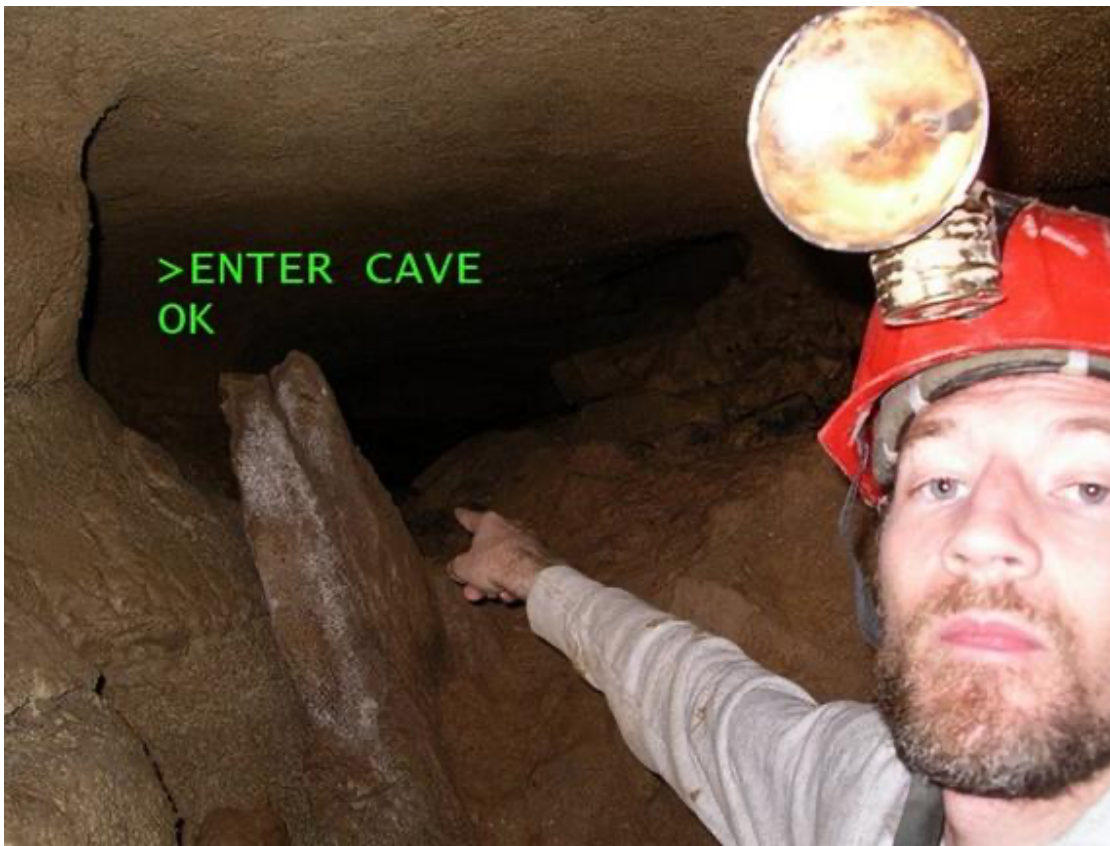


Figure 2. Wild Caves as Command Line Interface. Visitors hiking to the Bedquilt Entrance of Colossal Cave are likely to get tired, get ticks, and get lost. The benefit for a serious caver who actually makes it inside is the ability to choose destination and route, perhaps linking up known routes in new ways, or seeking unknown passages to “virgin cave”. Photo illustration by Dennis G. Jerz, © Cave Research Foundation 2005. Reproduced by permission.

Successors to “Adventure” were among the best-selling computer games of the 1980s. Even after the commercial market faded, hobbyists continued to play, review, and create interactive fiction. Indeed, the post-commercial IF community^[8] was producing valuable analysis and theory^[9] long before games began to emerge as an academic subject.

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Within the computer science field, Knuth (1998) used “Adventure” as his sole example in a 107-page tutorial on “literate programming” — coding for human readers as well as machines. His text carefully translates the Crowther/Woods FORTRAN code to CWEB, prefacing each section of code with a discussion of how the rules defined in each section of code affect the gameplay.

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You get to wander around until you've located all fifteen treasures, although you need not have taken them yet. After that, you enter a new level of complexity: A global variable called *clock1* starts ticking downwards, every time you take a turn inside the cave. When it hits zero, we start closing the cave; then we sit back and wait for you to try to get out, letting *clock2* do the ticking. [Knuth 1998, 80]

Knuth expects his reader to have played “Adventure” multiple times, but offers his close reading of the code as the proper way to experience the work. His approach is the mirror image of Buckles (1985), whose dissertation on “Adventure” employs literary formalism to examine what she calls a “storygame” in terms of established genres such as the riddle and the folktale. Where Knuth’s procedural formalism argues “you cannot fully appreciate the astonishing brilliance of its design until you have seen all of the surprises that have been built in [the code]” [Knuth 1998, 1], Buckles explores the narratives that her volunteer players generated as they attempted (often unsuccessfully) to make sense of their partial exposure to the simulated world. While Knuth and Buckles could hardly approach their subject more differently, both studies take “Adventure” as a given, without examining the cultural context in which Crowther and Woods created the text, or the context in which its first players interpreted it. *Twisty Little Passages* [Montfort 2003],

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which takes its title from an infamous maze in “Adventure”, presents a detailed analysis of the cultural origins and significance of “Zork”, a similar game that was inspired by “Adventure” [Anderson 1985]. While Montfort offers an excellent overview of canonical knowledge about “Adventure” and later developments in the genre of interactive fiction, much basic scholarly work on “Adventure” has remained.^[10]

Despite the historical importance of text adventures (they created the first market for home computer games), IF has only rarely attracted serious attention from digital scholars. Notable exceptions include Aarseth's reading [Aarseth 1997] of Marc Blank's 1982 “Deadline”, and, of course, Montfort's ongoing work.^[11] Nevertheless, Aarseth's complaint about authors who overlook “Adventure” remains valid. Murray mentions “Adventure” only in an end note, describing Crowther's original as a 1972 map and attributing the fantasy elements entirely to Woods [Murray 1997, 290]. Douglass uses the more accurate date of 1975, but re-affirms a stubborn meme when he describes “Adventure” as a “spelunking simulation... expanded by Don Woods into a Tolkein-esque fantasy” [Douglass 2007, 129]. A recent article in the *New York Times* completely overlooks “Adventure”, stating “Zork introduced the world to the adventure game” [Chaplin 2007]. Yet Costikyan is too scrupulous, using *Colossal Cave* to refer to the Crowther original and *Adventure* to refer to the Woods expansion, representing them as two different examples of interactive fiction [Costikyan 2007, 5]. While other scholarship focusing on more recent works of interactive fiction includes Douglass's analysis of Plotkin's 2000 “Shade” and brief author notes by Montfort, Meretzky and Short [Harrington and Wardruip-Fruin 2007], and Keller's ethnographic “Gaming, Identity and Literacy” [Selfe and Hawisher 2007], the historical and cultural role of “Adventure” itself remains under-examined.

In the realm of journalism, Dibbell (2002) revisits and summarizes canonical sources on “Adventure”, drawing on sources such as Nelson (2001) and Aarseth (1997), but the article, written for a general reader, contributes no new knowledge. Douglass (2006) lists “a fairly constrained set of talking points” that gaming and mainstream articles about interactive fiction typically follow: for instance, works of IF “started the computer game industry”, “were killed by graphics cards”, and “are still being made!” The formulaic nature of these stories is due in part to the journalist's obligation to introduce readers to an unfamiliar genre; regrettably, such boilerplate coverage can perpetuate faulty assertions. A March 2002 *GameSpy* article is a typical example of the resilience of various memes that have entered the realm of common knowledge:

The year was 1972. Crowther, an amateur spelunker distraught over a recent divorce, wanted to create a game that he and his kids could play on the computer together. He whipped up a computer text simulation of the Mammoth Caves in Kentucky... Of course there were no puzzles in Crowther's version, just a mighty underground realm to explore. Enter Don Woods, who found a copy of the game on the primitive Internet. He asked permission to play with the source code and the result was *Adventure* (sometimes called *Colossal Caves*). He added treasures to collect, monsters, traps, puzzles, and more. [Gamespy 2002]

Little evidence has been available to challenge many of these assumptions, as well as others (such as the claim that Crowther based his game not on *Colossal Cave* but a nearby cave named *Bedquilt*, or that Don Woods hacked his way into Crowther's account). New interviews with Crowther, his family members, and his associates (see Section 4) establish that Crowther *did* present his game as a post-divorce activity for his children (although he also shared it with his *Dungeons and Dragons* friends); Crowther was a caver (but “In those days, the thing I cared most about was rock climbing,” [O'Neill 1990, 5]); the game was based on one section of the Mammoth Cave system in southwestern Kentucky, which contains *Colossal Cave* (a sub-network with many entrances, of which Crowther featured one named *Bedquilt*); and Stanford University graduate student Don Woods *did* find Crowther's abandoned program (not by hacking, but simply by playing a copy that someone else had placed on a computer at the Stanford medical school; see Cordella [2001]). Woods had previously estimated a March or April 1976 release date [Cordella 2001], but now he agrees with the 1977 claim made by the present study [Woods 2007].

Crowther's original source code,^[12] which had been presumed lost for decades, was recovered in 2005 from a backup of Don Woods's student account at the Stanford Artificial Intelligence Lab (SAIL).^[13] The recovered files, dated March

1977, and bearing the in-game message “WELCOME TO ADVENTURE!!”, confirm that Crowther's original was in fact a game, with puzzles (such as a sequence that involves interactions between a rusty rod, an empty birdcage, a bird, and a snake), subtle humor (such as the surprising way that the bird helps the player get past the snake), and fantasy (including a magical crystal bridge, magic words, and combat with axe-wielding dwarves). Yet Crowther's adventures in Colossal Cave began earlier, via the Cave Research Foundation (CRF). Several caving resources shed light on the pre-history of “Adventure”, including Crowther's 1975 map of the Bedquilt region of Colossal Cave (sometimes confused with Crowther's original game), and a manual describing recreational caving as the CRF practiced it in the mid 70s. Insights gained from a recent CRF expedition to Colossal Cave — together with an analysis of the recovered source code and new feedback from Crowther, Woods, and others with knowledge of the original “Adventure” — clarify our understanding of an important digital artifact.

Cultural and Commercial Impact

When “Adventure” reached MIT in the spring of 1977, one group of players reacted by creating “Zork” and the company Infocom, whose text-adventure titles were best-sellers during the 80s. Other entrepreneurs inspired by “Adventure” included Scott Adams (founder of Adventure International), who published the lean but accessible “Adventureland” in 1978, and Ken and Roberta Williams (co-founders of Sierra On-Line), who produced the first graphic adventure game (“Mystery House,” 1980) after Roberta got hooked on “Adventure” [Levy 1984, 294–295]. In 1978, Atari employee Warren Robinett reworked the general exploration-and-treasure premise into a 2D graphic game, also called “Adventure”, which sold a million units [Robinett 2000]. During the late 70s, text-based computer games had tactical advantages over games using the slow, blocky, and expensive graphics that were then cutting-edge.

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The day I discovered Dungeon [the mainframe, pre-commercial version of Zork] I decided the computer room was the best place at school....We had no color monitors, no videogames to play. Everything here was text, blocky white letters on black screens. Yet the words were seductive because they revealed a hidden order behind everything... [Bennahum 1998, 106, 108]

Last year's graphic games dated quickly due to rapid hardware advances, while last year's text games still appealed to this year's text gamers, which helped sales. Text games were also easily portable to multiple platforms, thereby increasing sales potential in a crowded market. When the PC and Mac emerged as the dominant hardware platforms in the late 80s, both the aesthetic and economic advantages of text adventures evaporated.

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Nevertheless, many things that “Adventure” players enjoyed — logic and resource-management puzzles and the exploration of a complex virtual topography within the context of a framing story — remain staples in adventure, role-playing, and multiplayer game genres. Further, many elements that “Adventure” did not implement — complex non-player characters, believable AI, dynamic branching plots — still elude today's game designers. Former Infocom supervisor Dan Horn, reflecting on Infocom's failure to secure a foothold in the emerging multiplayer, real-time role-playing genre, blames his company's “bad business decisions. Imagine if you will [Infocom's] Sorceror, Planetfall, and Deadline with the EverQuest [graphical] engine, amazing... but lost forever” [Briceno et al. 2000, 44]. In a review of Electronic Entertainment Expo 2000, Au (2000) describes the action-centered blockbuster mentality that tends to obscure the importance of innovative niche titles: “Lured by the siren song of ever-improving graphics power, terrified by the risks involved with truly unique ideas in gaming, the industry is collectively stumbling along a path well-worn by Hollywood,” which uses non-stop action and visual spectacle to compete against itself for the quickest path to the consumer's dollar. A 2002 column in the *New York Times* suggested that the commercial gaming industry's quest for graphic realism is misguided, and perhaps even at odds with the elemental pleasure of identifying and mastering a set of rules: “One of the major goals of video game systems has been to simulate the real, to create images so lifelike, and movements so natural that there is no sense of artifice,” yet paradoxically, “the technology is put in service to creating a world that could very well do without it” [Rothstein 2002]. Because interactive fiction authors can draw on an existing body of narrative techniques, as well as emergent code-based interaction techniques, the medium (free from the corporate pressures associated with team-based development) is well-suited to individual experimentation and innovation.

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Story, Rules, and Interactive Fiction

Observing the joint activities of Hollywood and Silicon Valley, Poole speaks optimistically of a

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new pragmatism among video game designers: concentrating on what they alone can provide, rather than chasing the fashionable dream of interactive narrative, or uncritically seeking convergence with the cinema. Instead, especially in their concentration on character, videogames are carefully strip-mining our conventional notions of narrative and storytelling for what can be usefully simulated in their own, utterly different, medium. [Poole 2000, 111]

According to Poole, narrative-driven games that aim to model personality are advancing an effort begun by text-adventures, which were, during the 80s, “the most promising avenue for success in this field” [Poole 2000, 106]. Poole's intimate knowledge of contemporary gaming culture offers more first-person acuity than the influential *Hamlet on the Holodeck* [Murray 1997], which draws more insight from gamer narratives (and analyses of game-like experiences in *Star Trek*) than from the games themselves. Eskelinen is, however, too harsh [Eskelinen 2001] when he takes Murray to task for interpreting the Russian “Tetris” as a commentary on disorder in the overly-scheduled American lifestyle. To Eskelinen, Murray commits “interpretive violence” by ignoring “the actual game” and instead trying “to interpret its supposed content, or better yet, project her favourite content on it.” Murray's approach fails, according to Eskelinen, because “consequently we don't learn anything of the features that make *Tetris* a game”. By dismissing the value of examining his subject through any critical lens other than strict digital formalism, Eskelinen cleaves exclusively to one side of an unnecessary fissure between rules-based (ludological) and story-based (narratological) modes of games scholarship.^[14] This apparent opposition illustrates the postmodern assertion that, owing to the socially-constructed nature of “meaning,” different readers will inevitably find different meanings in a given text. For example, Buckles (1985) investigates the unique narratives that “Adventure” players constructed, examining how these stories helped players construct a working understanding of the game's puzzles. Such an approach privileges the perspective of a payer without access to the source code, yielding insights that differ from those achieved through Knuth's code-based approach, which does not examine the role imagination plays in retaining (or losing) the player's interest when the rules seem impenetrable. When discussing the postmodern emphasis on the reader's interpretive act rather than the writer's authorial power, Hutcheon (1988) offers the textual variability of interactive fiction as “the most extreme example I can think of” [Hutcheon 1988, 77]. A binary approach to digital formalism does not mesh well with the axiom, familiar to literary critics, that seeking out diverse and indeed conflicting interpretations of a bounded text is a normal component of the acquisition of knowledge (so long as these interpretations are supported by evidence, thereby anchoring the interpretation on the safe side of the slippery slope).

Hutcheon's observation highlights Aarseth's distinction between the infinite variable *interpretations* of any traditional text and the constrained variable content of a cybertext (1997, p. 3). Even after accepting that variable *content* is a defining principle of a cybertext, we are still free to recognize that variable content is as open to variable *interpretation* as any fixed text. For example, to a generation raised on *Star Trek* or to scientists familiar with the latest chatterbots, Weizenbaum's “ELIZA” (1966) seems unimpressive as an implementation of artificial intelligence; yet when examined as a controlled expression of the angst that many in the general public felt about contemporary technology, or when taken as a withering parody of a touchy-feely 1960s psychiatrist, the same program gains new relevance. Poole quotes Richard Darling (a developer with the British company Codemasters) regarding the “ELIZA”-as-game: “I think, that in the games world, [artificial intelligence] hasn't to me actually exceeded that excitement level” [Poole 2000, 107]. In fact, because it had such a big impact on non-specialists who had previously seen nothing like it, “ELIZA” may be more *culturally* significant than the more sophisticated chatterbots that followed it. But perhaps even more fundamental is the observation that humans reach for anthropomorphic images when confronted with computer behavior that they do not understand; the name given to this tendency — the “ELIZA effect” — is one example of the program's cultural legacy. “Tetris” has its own cultural legacy; Murray presumably encountered the game within the context of her own overscheduled American lifestyle. The marketing emphasized the game's Soviet origins, capitalizing on the American consumer's interest, during the last years of the Soviet Empire, in participating — at least symbolically — in *glasnost* and *perestroika*, therefore giving casual gamers a reason to try a title that might not otherwise have appealed to them. The “actual game,” then, is not only the set of abstracted rules that interests Eskelinen, but also a cultural artifact upon

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which humans (from marketers to players to games scholars) project their own concept of meaning according to their own unique values.^[15]

The first comprehensive assessment of the cultural history of interactive fiction is found in Nelson's *Inform Designer's Manual* 4th ed. [Nelson 2001] (an encyclopedic reference for one of several highly-advanced programming languages used by the interactive fiction hobbyist community). An appendix offers an overview of the genre, beginning with the story of Stephen Bishop, a cave explorer, cartographer, and former slave, who worked as a tour guide in Colossal Cave in the hopes of buying freedom for his wife and children. "It's hard not to feel a certain sadness that the first adventure game was shaped by those two lost souls, Bishop and Crowther, each like Orpheus unable to draw his wife out of the underworld" [Nelson 2001, 344]. While the comparison of a cave beloved by both men to slavery, divorce, and death may seem melodramatic, Nelson aptly identifies the pathos which contextualizes the adventures Bishop and Crowther experienced in Colossal Cave. For Crowther's children, Sandy [Lawrence 2002] and Laura [Carter 2002], playing computer games (including their father's original game, and later the version Woods expanded) was always part of visiting their father after the divorce. One of Crowther's former caving companions recalled CRF culture in the early 70s in utopian terms, describing the breakup of the Crowthers' marriage as a catastrophic event; this mutual friend was himself clearly suffering 30 years later. Another caver who was with the Crowthers on an expedition in the summer of 1975 reports that one glance at "Adventure" was enough to identify it immediately as a cathartic exercise, an attempt by Will to memorialize a lost experience.

"Adventure" was written for fun and shared for free; it was the cultural product of an educated, puzzle-loving, and fundamentally altruistic geek culture. Had it been better suited to the expectations of the non-technical public, it would likely have been less interesting to the community of computer specialists and entrepreneurs who responded by creating their own variations. In his editorial in the first issue of *Game Studies*, Aarseth (2001) sketches a game studies manifesto urging scholars to examine not only the huge industrial players, but also the activities of the "world-wide, non-commercial, collective games movement." Writing of the game modding community, Au (2002) observed that mods (amateur variations upon and expansions for commercial products) "represent the most visible success of the free software movement on the larger culture. For the millions who play computer games, the same ethos of volunteerism and shared ownership that characterizes free software has helped utterly transform the gaming experience and the \$8 billion-plus gaming industry." In a similar vein, Ryan (2001) articulates a vision of what might happen "if computer games could emancipate themselves from the tyranny of the market," which, as is the case in Hollywood, forces developers to appeal to the broadest audience. Contrasting the high overhead of games with the low cost of producing literature, Ryan posits that "if games could enjoy a comparable freedom of expression, we might see hybrids of literature and games which would place greater aesthetic emphasis on the plot" (fn. 9). There are, of course, computer games that succeed without compelling plots; however, by nature, interactive fiction invites and rewards a narratological approach more readily than other gaming sub-genres.

Poole observes that a generation ago, cinema and jazz studies occupied only marginal spaces in academia; yet they are today considered respectable subjects for examination (13). A close relation of the adventure game, the MUD, has already drawn considerable academic attention.^[16] The rhetorical connections between contemporary IF and MUDs have not been fully explored, even though the first MUD was a hacked version of a text adventure game. Arguing against the received notion that advances in computer technology have made IF irrelevant, Cadre (2004?) introduces his own collection of avant-garde IF titles by claiming "the *medium* of interactive fiction is no more a relic of the 1980s than the novel is a relic of the 17th century". With three decades of history but with so little basic research published, the text adventure genre remains a promising subject for digital humanities research.

Exploring Colossal Cave in Code

His daughter Sandy quotes Will Crowther as saying, "You know I've done all sorts of wonderful things in my career, it's funny that the one thing I'm remembered for is 'Adventure' " [Lawrence 2002]. Before he coded his legendary game, Crowther had helped map the complex network of caverns on which the game is based; and before *that*, he had already secured a place in history due to his contributions to a different network. As a member of the team of programmers at Bolt, Beranek and Newman (BBN), he helped create the ARPANET, the immediate forerunner to the internet.

Historical and Cultural Context

While BBN was actively researching artificial intelligence at the time Crowther was building “Adventure”, the game “was just some rather simplistic logic and a small table of known words — of course backed up by some very clever thinking,” according to Krale (2004), whose office was across from Crowther’s. Krale joined Crowther in a months-long Dungeons and Dragons campaign (led by Eric Roberts and including future Infocom co-founder Dave Lebling among the core of about eight participants). “[O]ne day, a few of us wandered into [Crowther’s] office so he could show off his program. It was very crude in many respects — Will was always parsimonious of memory — but surprisingly sophisticated. We all had a blast playing it, offering suggestions, finding bugs, and so forth.” Crowther’s original Adventure impressed his colleagues. “Will was very proud - or more accurately amused - of how well he could fool people into thinking that there was some very complex AI behind the game,” according to Krale. Nevertheless, “once it was working, Will wasn’t very interested in perfecting or expanding it.”

Crowther has described himself putting a copy of the game on his BBN computer, leaving for a month’s vacation, and returning to find the game being played all over the internet [Hafner 1994]. Among those who found the game at this stage were two Stanford graduate students, Don Woods and John Gilbert. According to Gilbert (2005), someone (possibly the instructor, Bob Floyd) mentioned the game in their CS204 class (a “programming and problem-solving seminar”) — after which Gilbert and Woods “stayed up all night at the AI lab playing the game and mapping the cave, including scanning the binary code for character strings in order to guess what the possibilities were.” After contacting Crowther and requesting the source code, Woods greatly increased the game’s size, complexity, and polish. “In early 1977.... [w]hen *Adventure* arrived at MIT, the reaction was typical: after everybody spent a lot of time doing nothing but solving the game (it’s estimated that *Adventure* set the entire computer industry back two weeks), the true lunatics began to think about how they could do it better” [Anderson 1985]. During this time, Tom Van Vleck was a managing engineer at Honeywell. He describes “Adventure” as just another fad. “[S]ome staff members spent many hours at it. Others played it once or twice, showed it to relatives and friends, and lost interest. Gaming was not a source of interest in computing, or a way of recruiting people to the field: it was something we could do with the machine that was comprehensible to non-computer folks, who were often baffled about what a computer was and what we did” [Van Vleck 2001]. But at MIT, a group of hackers was sufficiently captivated by “Adventure” that they developed a similar game, “Zork,” along with a company, Infocom, to market it [Anderson 1985]; [Briceno et al. 2000].

Analysis of Crowther’s Source Code

The earliest source code for Crowther’s PDP-10 “Adventure” game [Crowther 1976], exists in two FORTRAN files — one for data, and one for code, dated 11 Mar 1977. According to Woods (2007), these files show the program as Crowther left it, before Woods began debugging and expanding the code. The data file comprises six separate tables that contain most of the game’s text: 1) long descriptions, 2) short room labels, 3) map data, 4) grouped vocabulary keywords, 5) static game states, and 6) hints and events. Embedded in the code file are the static components of variable strings, such as “ I SEE NO ‘A5,’ HERE.” (where “A5” represents the name of an object). All text was written in all-caps due to the limitations of the PDP-10.

Table 1 [Long Descriptions]

1 YOU ARE STANDING AT THE END OF A ROAD BEFORE A SMALL BRICK
1 BUILDING. AROUND YOU IS A FOREST. A SMALL
1 STREAM FLOWS OUT OF THE BUILDING AND DOWN A GULLY.
2 YOU HAVE WALKED UP A HILL, STILL IN THE FOREST
2 THE ROAD NOW SLOPES BACK DOWN THE OTHER SIDE OF THE HILL.
2 THERE IS A BUILDING IN THE DISTANCE.
3 YOU ARE INSIDE A BUILDING, A WELL HOUSE FOR A LARGE SPRING.

The first line in the data file is not the first text displayed when the game starts, or the first instruction executed by the

computer; rather, it is simply the first row in a table that stores long descriptions of game locations. Its 149 lines present 78 separate items numbered from 1-79 (omitting number 26). Items 42-58 include ten locations with the identical description "YOU ARE IN A MAZE OF TWISTY LITTLE PASSAGES, ALL ALIKE," representing locations in a challenging three-dimensional maze. (Woods added a separate maze, with rooms that are "ALL DIFFERENT.") Typically, the items in this table are displayed when the player has changed location, but some describe an unexpected game state.

- 20 YOU ARE AT THE BOTTOM OF THE PIT WITH A BROKEN NECK.
- 21 YOU DIDN'T MAKE IT
- 22 THE DOME IS UNCLIMBABLE
- 23 YOU CAN'T GO IN THROUGH A LOCKED STEEL GRATE!

Table 2 [Short Room Labels]

- 1 YOU'RE AT END OF ROAD AGAIN.
- 2 YOU'RE AT HILL IN ROAD.
- 3 YOU'RE INSIDE BUILDING.

Table 2 holds 27 one-line items, numbered from 1-68, with many gaps. The entries in Table 1 that report failed attempts to move to the requested location, such as items 20-23 above, have no corresponding labels in Table 2. Rooms with short descriptions, such as #29 ("YOU ARE IN THE SOUTH SIDE CHAMBER.") and most maze locations, also have no corresponding Table 2 entry.

- 18 YOU'RE IN NUGGET OF GOLD ROOM.
- 19 YOU'RE IN HALL OF MT KING.
- 33 YOU'RE AT Y2
- 35 YOU'RE AT WINDOW ON PIT

Slightly more than half of the lines end with periods; the rest are unpunctuated.

Table 3 [Map Data]

1	2	2	44					
1	3	3	12	19	43			
1	4	4	5	13	14	46	30	
1	5	6	45	43				
1	8	49						
2	1	8	2	12	7	43	45	30
2	5	6	45	46				
3	1	3	11	32	44			
3	11	48						
3	33	65						
3	79	5	14					

Table 1.

Table 3 links map locations with vocabulary word groups. Experienced coders are invited to spelunk the FORTRAN source directly [Crowther 1976]; those who are unfamiliar with the language may appreciate a brief guided tour on how this table handles player navigation. The line "1 2 2 44", when interpreted by the code, means "When in room 1 ('YOU'RE AT END OF ROAD AGAIN'), print out the strings in Table 1 marked with value 2 ('YOU HAVE WALKED UP A HILL, STILL IN THE FOREST / THE ROAD NOW SLOPES BACK DOWN THE OTHER SIDE OF THE HILL. / THERE

IS A BUILDING IN THE DISTANCE.') in response to the player typing keyword 2 ('ROAD') or a keyword from group 44 ('WEST' or 'W'). Then, move the player to room 2, 'HILL IN ROAD'."

The line "3 1 3 11 32 44" represents several ways to get from room 3 ("YOU'RE INSIDE BUILDING") to room 1 ("YOU'RE AT END OF ROAD AGAIN"). These include several words ("ENTER", "DOOR" and "GATE") that Table 4 lists with a value of 3; another set ("OUT", "OUTSI", "EXIT", and "LEAVE") with a value of 11; the word "OUTDO[ORS]" (which has a value of 32) and "WEST" and "W" (which we have already seen carry the value of 44).

The table handles some special events very efficiently. For instance, the Table 3 [Map Data] line "3 79 5 14" defines what happens when the player is in room 3 ("YOU'RE INSIDE BUILDING") and types "DOWNS" or "STREAM" — a reasonable request, but one that the game does not permit. The game prints out the strings from Table 1 marked with value 79, or "THE STREAM FLOWS OUT THROUGH A PAIR OF 1 FOOT DIAMETER SEWER / PIPES. IT WOULD BE ADVISABLE TO USE THE DOOR." Since the game has refused the requested action, the player should not end this turn in room number 79 (which does not exist), but rather should stay in room 3. The Table 3 [Map Data] entry for value 79 is "79 3 1", which we may translate as "When temporarily in fake room 79, move the player to room 3 if the player has entered vocabulary keyword group 1." But there is no vocabulary keyword group 1; the vocabulary word groups start with a value of 2. Just as room 79 is a room the player cannot visit, vocabulary group 1 represents a keyword that the player can never type. The code is set up to respond to these values by delivering a customized rejection message and returning the player to the room where the turn started.

The line "3 11 48" will move the player from inside the building (3) to "YOU'RE IN DEBRIS ROOM" when the player types the keyword 48 — the famous magic word "XYZZY". Likewise, "3 33 65" describes how the player moves from inside the building to "YOU'RE AT Y2" (room 33) after invoking the magic word "PLUGH" (65).

Table 4 [Grouped Vocabulary Keywords]

This long table (193 items) represents every word the game recognizes, though all input is truncated to the first 5 characters. The first group of 93 lines stores strings that the game recognizes as attempts to move. These are numbered from 2-70 with some omissions and many duplicates.

2 ROAD
3 ENTER
3 DOOR
3 GATE
4 UPSTR
5 DOWNS
6 FORES

The numbering identifies the typed commands "ENTER", "DOOR" and "GATE" with a value of 3, marking them as synonyms. The last item in this section, numbered 70, is "BEDQU[ILT]". Most of these words are the names of specific locations, but words for general motion ("BACK", "RETUR[N]" and "RETRE[AT]") are also on the list.^[17] While Adventure lore commonly reports that Crowther created the game for his young daughters, the keyword table suggests Crowther also had adult players in mind. The last keyword is an expletive.

While navigation by compass directions is perhaps one of the most recognizable features of the text-adventure genre, the compass directions seem to have been added relatively late to the vocabulary data table. Thus, dozens of names for locations from the initial above-ground sequence ("HOUSE", "GATE", "FORES[T]") and words associated with a more linear navigation style ("FORWA[RD]", "BACK", "ENTER" and "EXIT") are numbered 2-26, with synonyms such as "NULL" and "NOWHE[RE]" sharing numbers. Terms for the concepts "UP" and "DOWN" and several synonyms appear at numbers 29 and 30, respectively, while the four cardinal compass directions appear in numbers 43-46, and the diagonals at 60 and 62-64. William F. Mann, a caver who "helped a bit with the mapping of the Bedquilt area" depicted in the game, recalls playing "several versions of ADVENTURE as they were being developed" [Mann 2003]. According

to Mann, the game had always included compass directions; he suggests that the late appearance of the compass directions in the vocabulary table indicates that Crowther moved that feature from the code file to the data file at that stage of development. Further evidence that supports the assertion that compass directions were always an important way of navigating in the game is found in Table 6, in which items 10, 11 and 14 are displayed variously when the player is having trouble navigating. Each of these first suggests navigation by compass points, then via place names (e.g. item 10: "I AM UNSURE HOW YOU ARE FACING. USE COMPASS POINTS OR NEARBY OBJECTS.").

A second group of 35 items, numbered from 1001-1023 with some omissions and duplication, represents objects, including props that can be picked up (e.g. the keys and various treasures), scenery items that affect the player's motion (e.g. the rough stone steps and the fissure in the Hall of Mists), and adversaries (the snake and the dwarves).

33

- 1001 KEYS
- 1001 KEY
- 1002 LAMP
- 1002 HEADL
- 1003 GRATE
- 1004 CAGE
- 1005 ROD
- 1006 STEPS

Item 1018 and item 1022 are both given as "KNIFE", but only item 1018 is set up to accept the synonym "KNIVE[S]". Note that "HEADL[AMP]" is given as a synonym for "LAMP," reflecting the caving practice of keeping the hands free by mounting the light source on one's head. (Don Woods added the synonym "LANTE" and referred to the light source as a "LANTERN.")

34

A third group of 53 lines covers 16 more commands, including 12 synonyms for "TAKE", five for "RELEA[SE]", and nine for "WALK".

35

An examination of this table reveals several insights. Crowther's original version contains no vocabulary words to represent commands for saving a game, reporting the score, or taking inventory of possessions; all these elements were added by Woods. One of the most versatile objects in the Crowther/Woods collaboration, the bottle — which can be empty or full, and refilled with water or oil — exists in a greatly simplified form in the Crowther original. The word "BOTTL[E]" and the word "WATER" both have the number 1020, indicating that the container and its contents were treated by Crowther as the same object. There are table entries for "POUR" and "DRINK," both of which will set a flag that indicates the bottle is empty; yet there are no commands for refilling the bottle. Since the last prop in this list is 1023, the numbering suggests Crowther added the bottle at a late stage in the game's development.

36

Table 5 [Static Game States]

- 201 THERE ARE SOME KEYS ON THE GROUND HERE.
- 202 THERE IS A SHINY BRASS LAMP NEARBY.
- 3 THE GRATE IS LOCKED
- 103 THE GRATE IS OPEN.
- 204 THERE IS A SMALL WICKER CAGE DISCARDED NEARBY.
- 205 A THREE FOOT BLACK ROD WITH A RUSTY STAR ON AN END LIES NEARBY

This short table (24 items) includes descriptions of game states that represent lasting changes to the environment. For example, if the player drops the keys in a room, then every time the player returns to the room, a message will indicate the presence of the keys. Some of these table entries describe obstacles, and others describe room features. Exclamation points emphasize the importance of valuable items, threats, and unexpected consequences.

37

- 209 ROUGH STONE STEPS LEAD UP THE DOME.

210 THERE IS A LARGE SPARKLING NUGGET OF GOLD HERE!

11 A HUGE GREEN FIERCE SNAKE BARS THE WAY!

112 A CRYSTAL BRIDGE NOW SPANS THE FISSURE.

The numbering here is not sequential, because the hundreds digit is used to indicate an alternate state — e.g. item 3 defines the locked grate, and item 103 defines the unlocked grate.

38

Table 6 [Hints and Events]

The final table in the data file, 132 lines long, contains 80 numbered groups of lines that offer hints and descriptions of one-time game events (rather than enduring state changes, such as Table 5 contains).

39

1 SOMEWHERE NEARBY IS COLOSSAL CAVE, WHERE OTHERS HAVE FOUND

1 FORTUNES IN TREASURE AND GOLD, THOUGH IT IS RUMORED

1 THAT SOME WHO ENTER ARE NEVER SEEN AGAIN. MAGIC IS SAID

1 TO WORK IN THE CAVE. I WILL BE YOUR EYES AND HANDS. DIRECT

1 ME WITH COMMANDS OF 1 OR 2 WORDS.

1 (ERRORS, SUGGESTIONS, COMPLAINTS TO CROWTHER)

1 (IF STUCK TYPE HELP FOR SOME HINTS)

2 A LITTLE DWARF WITH A BIG KNIFE BLOCKS YOUR WAY.

3 A LITTLE DWARF JUST WALKED AROUND A CORNER, SAW YOU, THREW

3 A LITTLE AXE AT YOU WHICH MISSED, CURSED, AND RAN AWAY.

Crowther's prose was lean and condensed, as we see in item 3. The subject "DWARF" is followed by a tight array of six verbs, of which the first three ("WALKED," "SAW" and "THREW") pertain to the subject, the next ("MISSED") pertains to the direct object ("AXE"), and the final two ("CURSED" and "RAN") pertain to the subject. The compressed structure leads to an amusing ambiguity, suggesting that the axe not only missed, but also cursed and ran away.

40

Notes on the Woods Expansion

Mann's assessment of the Crowther/Woods collaboration offers an apt summary: "Crowther was interested in using the cave as a setting for a game, with magic, puzzles, conflict, and humor. Woods carried that forward, but without the feel for being in an actual cave, and with a need to limit the use of the machine to off hours. He added mostly policy, puzzles and humor" [Mann 2004]. Crowther supplied the original text-parser and established the basic principles of gameplay, leaving Woods free to concentrate on expansion, creative variation, and real-world resource management (such as a system for resuming a suspended game and a password-protected method of restricting access to the game during working hours). Woods retained the general structure of the code when he expanded the game, typically adding on to the end of the existing tables, and squeezing creative variations out of his own imagination and out of possibilities he found in Crowther's original material. For example, Crowther's original responds to the command "BLAST" with the message "BLASTING REQUIRES DYNAMITE," but none exists in his game. Woods, however, incorporates "BLAST" into the finale.

41

Woods added several rooms to Crowther's existing "ALL ALIKE" maze (making the maze more challenging to navigate), and created his own maze, where the passages were "ALL DIFFERENT." He also created a randomly-moving pirate who steals the player's treasures. Crowther supplied the humorous solution to the snake obstacle, but when the player tries to unleash the same feathered fury on Woods's dragon, the results are comically disastrous. While Crowther's bottle of water can only be emptied, Woods adds complexity by making it refillable and capable of carrying water or oil. Woods also supplied puzzles for Crowther's consumable items (the food and the water). In a variation on the crystal bridge that can appear, Woods adds a bridge that can collapse.

42

Where Crowther was an efficient minimalist, Woods was comparatively lavish with scenery. Crowther did not create corpse objects for vanquished opponents; once defeated, the snake and the dwarves simply vanish. Woods, on the

43

other hand, implements separate functional and destroyed objects for the dragon, the bear, and the troll bridge. He also created a plant that exists in three states – thirsty and small, thirsty and large, and sated and climbable. Because Woods added objects with complex behavior, his code had to deal with an even greater number of potential events. (For example, what happens when a wandering dwarf encounters the bear or the dragon?)

Woods edited for standard usage, and occasionally for clarity. Upon starting “Adventure”, the player's first choice is whether to ask for instructions (see Example 1, below).

44

Crowther, 1975-76

```
1 SOMEWHERE NEARBY IS COLOSSAL CAVE, WHERE OTHERS HAVE FOUND
1 FORTUNES IN TREASURE AND GOLD, THOUGH IT IS RUMORED
1 THAT SOME WHO ENTER ARE NEVER SEEN AGAIN. MAGIC IS SAID
1 TO WORK IN THE CAVE. I WILL BE YOUR EYES AND HANDS. DIRECT
1 ME WITH COMMANDS OF 1 OR 2 WORDS.
1 (ERRORS, SUGGESTIONS, COMPLAINTS TO CROWTHER)
1 (IF STUCK TYPE HELP FOR SOME HINTS)
```

Crowther and Woods, 1977

```
1 SOMEWHERE NEARBY IS COLOSSAL CAVE, WHERE OTHERS HAVE FOUND
  FORTUNES IN
1 TREASURE AND GOLD, THOUGH IT IS RUMORED THAT SOME WHO ENTER ARE
  NEVER
1 SEEN AGAIN. MAGIC IS SAID TO WORK IN THE CAVE. I WILL BE YOUR EYES
1 AND HANDS. DIRECT ME WITH COMMANDS OF 1 OR 2 WORDS. I SHOULD WARN
1 YOU THAT I LOOK AT ONLY THE FIRST FIVE LETTERS OF EACH WORD, SO YOU'LL
1 HAVE TO ENTER "NORTHEAST" AS "NE" TO DISTINGUISH IT FROM "NORTH".
1 (SHOULD YOU GET STUCK, TYPE "HELP" FOR SOME GENERAL HINTS. FOR INFOR-
1 MATION ON HOW TO END YOUR ADVENTURE, ETC., TYPE "INFO".)
1 - - -
1 THIS PROGRAM WAS ORIGINALLY DEVELOPED BY WILLIE CROWTHER. MOST OF THE
1 FEATURES OF THE CURRENT PROGRAM WERE ADDED BY DON WOODS (DON @ SU-
  AI).
1 CONTACT DON IF YOU HAVE ANY QUESTIONS, COMMENTS, ETC.
```

Example 1. Comparison of Instructions Text

Woods retained the purely aesthetic portion of Crowther's instructions (offering a motivation for the player's actions and introducing the fantasy element), but added details pertaining to the text parser, session mechanics, and authorship. While Crowther ended his instructions with a no-nonsense, “IF STUCK TYPE HELP FOR HINTS,” Woods expanded, qualified, and punctuated the statement thus: “SHOULD YOU GET STUCK, TYPE ‘HELP’ FOR SOME GENERAL HINTS”. Woods also added a note about the parser's inability to tell the difference between “NORTH” and “NORTHEAST,” illustrating the attention he paid to improving the playing experience.

45

Both versions offer hints accessible by typing “HELP” (see Example 2, below). To Crowther's original “HELP” text, Woods added a reference to the new verb “INVENTORY,” and clarified a passage referring to manipulating objects.

46

Crowther, 1975-76

51 I KNOW OF PLACES, ACTIONS, AND THINGS. MOST OF MY VOCABULARY
51 DESCRIBES PLACES AND IS USED TO MOVE YOU THERE. TO MOVE TRY
51 WORDS LIKE FOREST, BUILDING, DOWNSTREAM, ENTER, EAST, WEST
51 NORTH, SOUTH, UP, OR DOWN. I KNOW ABOUT A FEW SPECIAL OBJECTS,
51 LIKE A BLACK ROD HIDDEN IN THE CAVE. THESE OBJECTS CAN BE
51 MANIPULATED USING ONE OF THE ACTION WORDS THAT I KNOW. USUALLY
51 YOU WILL NEED TO GIVE BOTH THE OBJECT AND ACTION WORDS
51 (IN EITHER ORDER), BUT SOMETIMES I CAN INFER THE OBJECT FROM
51 THE VERB ALONE. THE OBJECTS HAVE SIDE EFFECTS - FOR
51 INSTANCE, THE ROD SCARES THE BIRD.
51 USUALLY PEOPLE HAVING TROUBLE MOVING JUST NEED TO TRY A FEW
51 MORE WORDS. USUALLY PEOPLE TRYING TO MANIPULATE AN
51 OBJECT ARE ATTEMPTING SOMETHING BEYOND THEIR (OR MY!)
51 CAPABILITIES AND SHOULD TRY A COMPLETELY DIFFERENT TACK.
51 TO SPEED THE GAME YOU CAN SOMETIMES MOVE LONG DISTANCES
51 WITH A SINGLE WORD. FOR EXAMPLE, "BUILDING" USUALLY GETS
51 YOU TO THE BUILDING FROM ANYWHERE ABOVE GROUND EXCEPT WHEN
51 LOST IN THE FOREST. ALSO, NOTE THAT CAVE PASSAGES TURN A
51 LOT, AND THAT LEAVING A ROOM TO THE NORTH DOES NOT GUARANTEE
51 ENTERING THE NEXT FROM THE SOUTH. GOOD LUCK!

Crowther and Woods, 1977

51 I KNOW OF PLACES, ACTIONS, AND THINGS. MOST OF MY VOCABULARY
51 DESCRIBES PLACES AND IS USED TO MOVE YOU THERE. TO MOVE, TRY WORDS
51 LIKE FOREST, BUILDING, DOWNSTREAM, ENTER, EAST, WEST, NORTH, SOUTH,
51 UP, OR DOWN. I KNOW ABOUT A FEW SPECIAL OBJECTS, LIKE A BLACK ROD
51 HIDDEN IN THE CAVE. THESE OBJECTS CAN BE MANIPULATED USING SOME OF
51 THE ACTION WORDS THAT I KNOW. USUALLY YOU WILL NEED TO GIVE BOTH THE
51 OBJECT AND ACTION WORDS (IN EITHER ORDER), BUT SOMETIMES I CAN INFER
51 THE OBJECT FROM THE VERB ALONE. SOME OBJECTS ALSO IMPLY VERBS; IN
51 PARTICULAR, "INVENTORY" IMPLIES "TAKE INVENTORY", WHICH CAUSES ME TO
51 GIVE YOU A LIST OF WHAT YOU'RE CARRYING. THE OBJECTS HAVE SIDE
51 EFFECTS; FOR INSTANCE, THE ROD SCARES THE BIRD. USUALLY PEOPLE HAVING
51 TROUBLE MOVING JUST NEED TO TRY A FEW MORE WORDS. USUALLY PEOPLE
51 TRYING UNSUCCESSFULLY TO MANIPULATE AN OBJECT ARE ATTEMPTING
51 SOMETHING
51 BEYOND THEIR (OR MY!) CAPABILITIES AND SHOULD TRY A COMPLETELY
51 DIFFERENT TACK. TO SPEED THE GAME YOU CAN SOMETIMES MOVE LONG
51 DISTANCES WITH A SINGLE WORD. FOR EXAMPLE, "BUILDING" USUALLY GETS
51 YOU TO THE BUILDING FROM ANYWHERE ABOVE GROUND EXCEPT WHEN LOST IN
51 THE
51 FOREST. ALSO, NOTE THAT CAVE PASSAGES TURN A LOT, AND THAT LEAVING A
51 ROOM TO THE NORTH DOES NOT GUARANTEE ENTERING THE NEXT FROM THE
51 SOUTH.
51 GOOD LUCK!

Crowther had written “USUALLY PEOPLE TRYING TO MANIPULATE AN OBJECT ARE ATTEMPTING SOMETHING BEYOND THEIR (OR MY!) CAPABILITIES...” Because players see this passage only after typing “HELP,” the context suggests that this passage refers to a player having difficulty manipulating an object; yet a novice player who encounters that passage very early in the game might conclude that the game does not permit any manipulation at all. Woods’s revision refers more precisely to “TRYING *UNSUCCESSFULLY* TO MANIPULATE AN OBJECT” (emphasis added). Likewise, where Crowther referred to manipulating objects using “ONE OF THE ACTION WORDS THAT I KNOW”, Woods avoided giving the impression that an object can be manipulated with *only* one action word, so that his passage refers instead to “*SOME OF THE ACTION WORDS*” (emphasis added).

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Crowther’s potent writing features in Room 13, “...A SPLENDID CHAMBER THIRTY FEET HIGH. THE WALLS ARE FROZEN RIVERS OF ORANGE STONE. AN AWKWARD CANYON AND A GOOD PASSAGE EXIT FROM EAST AND WEST SIDES OF THE CHAMBER.” A forthcoming study of caves as computer game environments assesses this passage as follows:

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While the player is informed that the chamber is “splendid,” the text does not explicitly state what emotional effect the height of the chamber or the proximity of the “frozen rivers of orange stone” is supposed to have. Rather, we see this location through seasoned, critical eyes, duly noting the presence of geological wonders, but then immediately evaluating the next possible move, as one must do when exploring in a real cave. As it happens, the “awkward” exit from the Orange River Room is the way back to the surface, and the “good passage” leads deeper into the cave. Without clumsily announcing something like, “The west exit looks so intriguing that you can hardly wait to explore it,” the text subtly discourages the player’s premature exit, and reinforces the exploratory premise of classic text adventures. [Jerz and Thomas 2005]

“Adventure” succeeds in large part due to the depth and realism of the scenery, which is rendered in concise prose that calls interesting details to the reader’s attention, yet leaves much to the imagination. The “Breath-Taking View” (Crowther and Woods, Room 126) is an exception; co-authored by Gilbert, the graduate student who played Crowther’s version of “Adventure” with Woods late into the night, its effusive language not only tells what the room looks like, but also informs the reader what emotions the scene is supposed to invoke (cf. the gorge “FILLED WITH A BIZARRE CHAOS OF TORTURED ROCK WHICH SEEMS TO HAVE BEEN CRAFTED BY THE DEVIL HIMSELF”). When Nelson analyzes the tension between Crowther’s austere fantasy vision and the often comical set pieces supplied by Woods, he finds the stylistic conflict an agreeable part of the game’s charm. “Stretching a point, you could say that there is a Crowther and a Woods in every designer, the one intent on recreating an experienced world, the other with a really neat puzzle which ought to fit *somewhere*” [Nelson 2001, 345]. Notable tension is evident in changes to the cave environment that occur in the Woods expansion, such as 1) the underground volcano, 2) the battery-dispensing vending machine, and 3) announcements from a public address system warning that the cave is closing. Lacking firsthand experience of caves, Woods had to rely upon his own imagination. Yet even these details logically extend, respectively, Crowther’s use of 1) intriguing geography, 2) treasure items, and 3) magic words. Some of Woods’s additions, such as the Soft Room and the Oriental Room, seem completely out of place when considered separately; but once it becomes clear that objects found in these two locations work together to solve an inventory puzzle, these two incongruities make perfect sense as gaming elements.

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In 1994, Crowther reflected on the success of the game: “And why did people enjoy it? Because it’s exactly the kind of thing that computer programmers do. They’re struggling with an obstinate system that can do what you want but only if you can figure out the right thing to say to it” [Hafner 1994, 2–3]. Crowther’s children both recall instances in which their father deflected their frustration with “Adventure” by noting that they were stuck on one of Woods’s details (see Section 4). According to Crowther (2001), “My intent was that the deeper you went into the cave, the more fantasy appeared. Don made it appear faster than ever I would have, which in retrospect was good”.

50

Woods’s most striking diversions from Crowther’s initial realism occur on the far side of the troll bridge, yet this region is

51

only accessible after the player has encountered Crowther's earlier scenery, which involves capturing a strangely passive little bird, watching the improbable defeat of a fierce snake, conjuring up a magical crystal bridge, teleporting via magic words, and fighting with dwarves whose corpses vanish. Given this context, the fairy-tale elements that Woods supplied (including a dragon, a troll, a beanstalk, more magic words, and a friendly bear) seem perfectly in keeping with Crowther's fantasy premise.

Exploring Colossal Cave in Kentucky

Woods's 1977 expansion of "Adventure" features "RECENT ISSUES OF 'SPELUNKER TODAY' MAGAZINE," and sources often describe Crowther as a "spelunker." Yet "[c]avers haven't called themselves spelunkers for almost 40 years now. They may belong to the National Speleological Society, but they don't spelunk. They cave." [Cahill 2001]^[18] Resources from caving culture, including an expedition to Colossal Cave, offer various insights on Crowther's "Adventure."

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Bedquilt Entrance, Colossal Cave

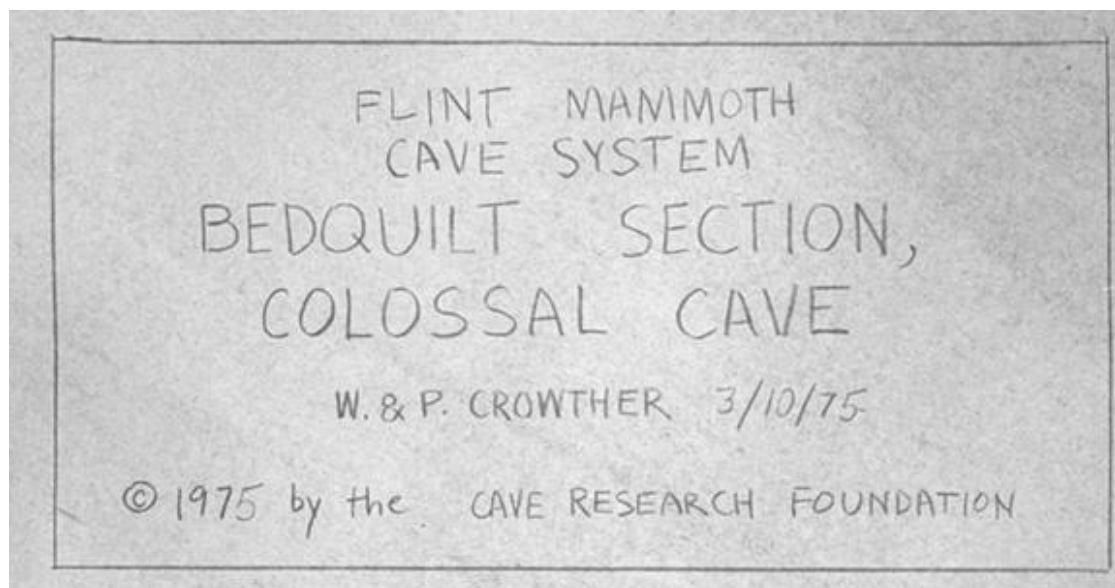


Figure 3. Flint Mammoth Cave System / Bedquilt Section, Colossal Cave. The title box of the survey map Will and Pat Crowther completed for the Cave Research Foundation represents Bedquilt as a section of Colossal Cave, rather than a separate nearby cave, as it has often been misunderstood. Photo by Dennis G. Jerz, © Cave Research Foundation 2005. Reproduced by permission.

In his popular online tribute to "Adventure", Adams (2001c) correctly identifies Colossal as part of the Mammoth system, but perpetuates a misunderstanding when he writes "the game is not actually based on that cave, but is instead a remarkably faithful reproduction of nearby Bedquilt Cave." In fact, Bedquilt is "nearby" Colossal Cave only in the sense that your back door is "nearby" your house.

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Figure 4. Bedquilt Entrance Label. Another detail from the same 1975 map of Colossal Cave. The boxed X indicates the horizontal grate leading into the cave. Photo by Dennis G. Jerz, © Cave Research Foundation 2005. Reproduced by permission.

Crowther's Map and Game

Crowther's frequent caving and mapping collaborator was his wife Pat, who in 1972 had distinguished herself in the caving community by making the final connection – that is, physically squeezing through a tiny hole — between two sprawling networks of caverns which had up to that point been considered separate entities. For years, using a compass and a measuring tape, survey teams from the Cave Research Foundation had recorded the coordinates of a sinewy array of 3D points. The Crowthers used the raw data to form a computer model. According to a Feb 6 1990 alt.folklore.computers posting written by the former Patricia Crowther [Wilcox 1990]: “We typed in all that survey data from muddy little books on a 110-baud teletype to a PDP-1.... Then generated plotting commands on huge rolls of paper tape, which we carried over and plotted using a salvaged Calcomp drum plotter attached to a Honeywell 316 that was destined to become an ARPAnet IMP.”

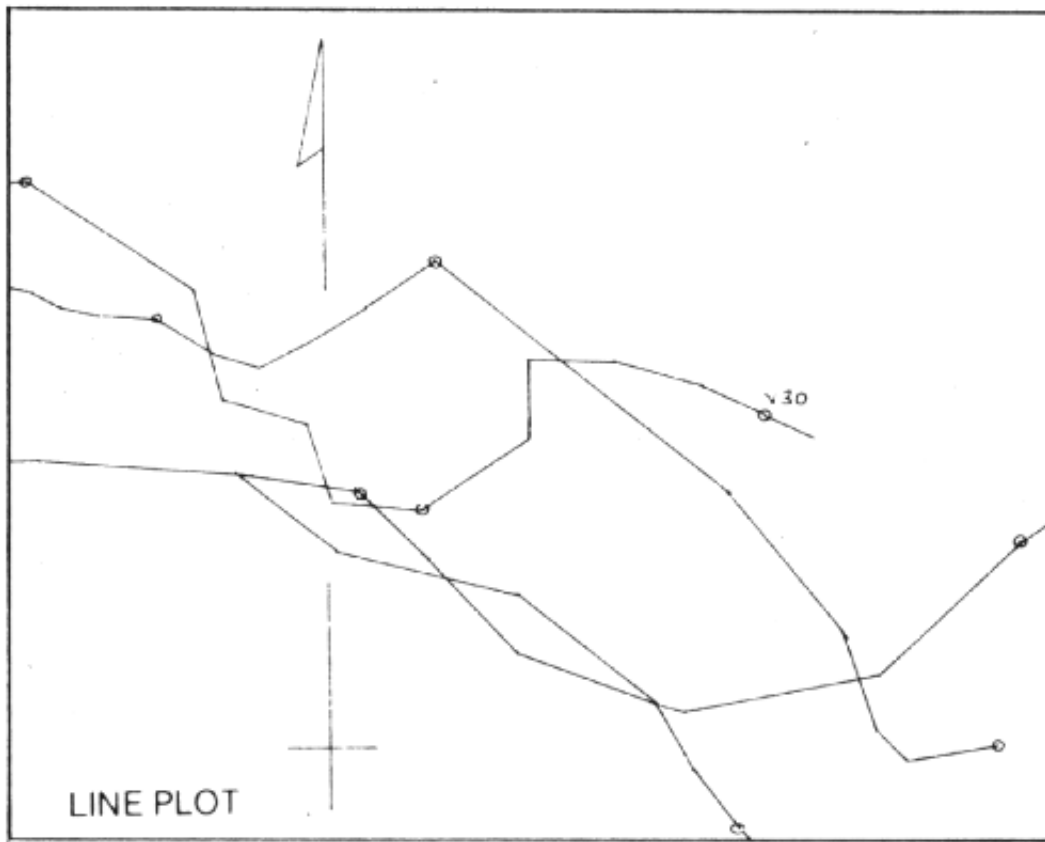


Figure 5. Cave Survey Line Plot. Did Will Crowther create a map-like cave simulation that was later turned into a fantasy role-playing game that we know as “Colossal Cave Adventure”? While both the graphical map and the textual game represent Crowther’s creative efforts to use computer technology to sort and communicate his intimate knowledge of this particular cave system, the two intellectual efforts were otherwise unrelated. In 1974, Crowther, a volunteer cartographer with the Cave Research Foundation, participated in an intense summer-long survey of the Bedquilt region of Colossal Cave. This line plot was published as an example of mapped survey data in Brucker and Watson’s 1975 *The Longest Cave* (32).

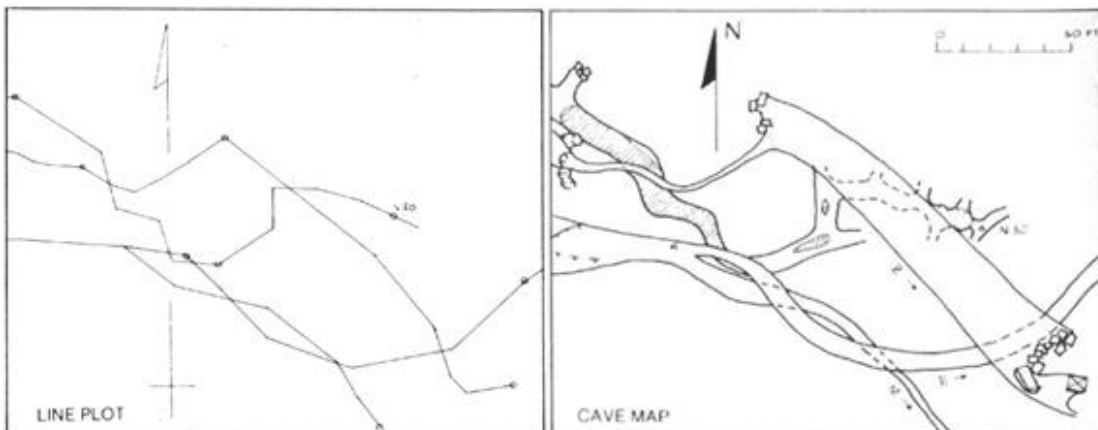


Figure 6. Line Plot and Sketches. Illustration: Using information taken down in sketchbooks by survey teams, Crowther, as volunteer cartographer for the Cave Research Foundation, helped flesh out the line plot maps (left) into more detailed environmental maps (right). These images, which represent the Bedquilt Entrance to Colossal Cave, appear without identification on page 32 of Brucker and Watson’s *The Longest Cave* (see Figure 4 above, for comparison).

Mapping the Bedquilt region of Colossal Cave involved using the line plots as the framework for hand-drawn details gleaned from sketches and notes taken during survey expeditions. While the resulting map can be understood as a technical and creative embellishment that makes the stark 3D dataset more accessible and more aesthetically appealing, it is a mistake to conflate either the 3D dataset or the 2D hand-drawn map with Crowther’s text-based game.

Woods's Co-Authorship

host% /usr/games/Adventure

Welcome to Adventure!! Would you like instructions?

yes

Somewhere nearby is Colossal Cave, where others have found fortunes in treasure and gold, though it is rumored that some who enter are never seen again. Magic is said to work in the cave. I will be your eyes and hands. Direct me with commands of 1 or 2 words. I should warn you that I look at only the first five letters of each word, so you'll have to enter "northeast" as "ne" to distinguish it from "north". (Should you get stuck, type "help" for some general hints. For information on how to end your adventure, etc., type "info".)

This program was originally developed by Will Crowther. Most of the features of the current program were added by Don Woods. Address complaints about the UNIX version to Jim Gillogly (jim@rand.org).

You are standing at the end of a road before a small brick building. Around you is a forest. A small stream flows out of the building and down a gully.

enter

You are inside a building, a well house for a large spring. There are some keys on the ground here. There is a shiny brass lamp nearby. There is food here. There is a bottle of water here.

get keys

OK

get lamp

OK

exit

You're at end of road again.

This transcript of Gillogly's early (July 1977) translation of "Adventure" from the Crowther and Woods FORTRAN code to C, shows the help text and the first few moves. Italicized passages represent the player's contributions.

Example 3. Gillogly-Schwartz Transcript 1

When Don Woods published his expansion, he added the following note to the in-game help text: "THIS PROGRAM WAS ORIGINALLY DEVELOPED BY WILLIE CROWTHER. MOST OF THE FEATURES OF THE CURRENT PROGRAM WERE ADDED BY DON WOODS (DON @ SU-AI)." Gillogly's translation of "Adventure" from FORTRAN to C preserves that line (editing it to change uppercase letters to lowercase when appropriate; see Example 3, above). Gillogly's source code [Gillogly 1977] also includes a brief technical note (in "hdr.h") that states, in part, "This program is a re-write of ADVENT, written in FORTRAN mostly by Don Woods of SAIL." While Woods's original note claims authorship of "MOST OF THE FEATURES OF THE CURRENT PROGRAM," the reference to the *current* version seems to imply that Woods was writing for an audience that had access to Crowther's original source code. Yet Gillogly's note describes the program generally as written "mostly by Don Woods," which seems to intensify Woods's authorial claims, or at least implies a different understanding of the term "features." In interviews, on his website, and in his source code, Woods has always given co-authorship credit to Crowther. Gillogly's phrasing may have contributed to the commonly-reported meme that Crowther's original version was a realistic map, and that all the game and fantasy elements are Woods's.

Comparative Sample: Words, Code, Map, and Images

The following exercise in multimedia intertextuality compares the first few rooms of the cave, as represented via text

from a session with Gillogly's "Adventure", Crowther's source data, his CRF map, and site photographs. Crowther's CRF map and his original game are completely different entities.

You are in a 20-foot depression floored with bare dirt. Set into the dirt is a strong steel grate mounted in concrete. A dry streambed leads into the depression. The grate is locked.

open grate

The grate is now unlocked.

down

You are in a small chamber beneath a 3x3 steel grate to the surface. A low crawl over cobbles leads inward to the west. The grate is open.

west

You are crawling over cobbles in a low passage. There is a dim light at the east end of the passage. There is a small wicker cage discarded nearby.

west

It is now pitch dark. If you proceed you will likely fall into a pit.

lamp on

Your lamp is now on. You are in a debris room filled with stuff washed in from the surface. A low wide passage with cobbles becomes plugged with mud and debris here, but an awkward canyon leads upward and west. A note on the wall says "Magic word XYZZY". A three foot black rod with a rusty star on an end lies nearby.

east

You are crawling over cobbles in a low passage. There is a dim light at the east end of the passage. There is a small wicker cage discarded nearby.

get cage

OK

west

You're in Debris Room. A three foot black rod with a rusty star on an end lies nearby.

get rod

OK

west

You are in an awkward sloping east/west canyon.

west

You are in a splendid chamber thirty feet high. The walls are frozen rivers of orange stone. An awkward canyon and a good passage exit from east and west sides of the chamber. A cheerful little bird is sitting here singing.

Illustration: This transcript from "Adventure" (compiled from [Schwartz 1999], which records a session with the Gillogly UNIX/C version), shows the player entering Colossal Cave via Bedquilt.

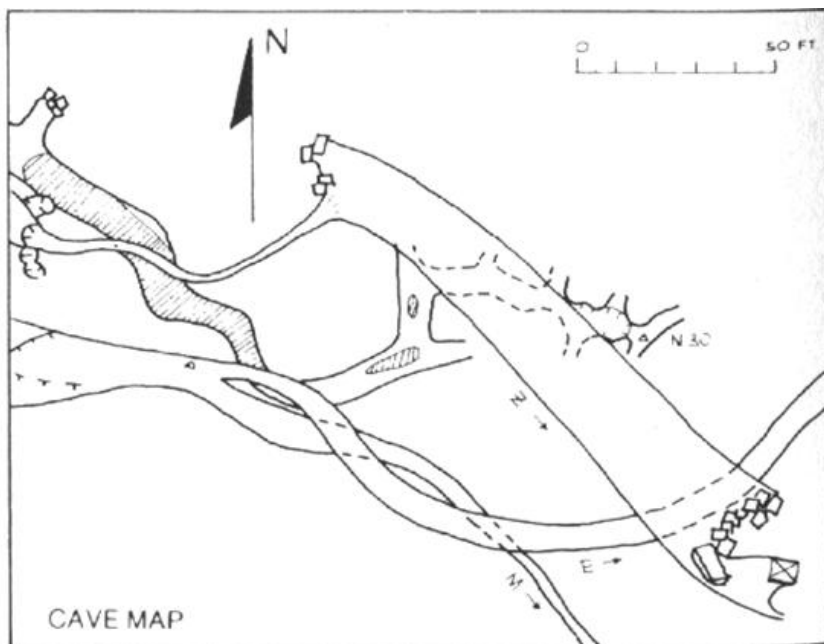
Example 4. Gillogly-Schwartz Transcript 2

9 YOU ARE IN A SMALL CHAMBER BENEATH A 3X3 STEEL GRATE TO THE
9 SURFACE. A LOW CRAWL OVER COBBLES LEADS INWARD TO THE WEST.
10 YOU ARE CRAWLING OVER COBBLES IN A LOW PASSAGE. THERE IS A
10 DIM LIGHT AT THE EAST END OF THE PASSAGE.
11 YOU ARE IN A DEBRIS ROOM, FILLED WITH STUFF WASHED IN FROM
11 THE SURFACE. A LOW WIDE PASSAGE WITH COBBLES BECOMES
11 PLUGGED WITH MUD AND DEBRIS HERE,BUT AN AWKWARD CANYON
11 LEADS UPWARD AND WEST.
11 A NOTE ON THE WALL SAYS "MAGIC WORD XYZZY".
12 YOU ARE IN AN AWKWARD SLOPING EAST/WEST CANYON.
13 YOU ARE IN A SPLENDID CHAMBER THIRTY FEET HIGH. THE WALLS
13 ARE FROZEN RIVERS OF ORANGE STONE. AN AWKWARD CANYON AND A
13 GOOD PASSAGE EXIT FROM EAST AND WEST SIDES OF THE CHAMBER.

Illustration: Excerpt from the data file for Will Crowther's original cave-exploration game. These lines represent locations the player encounters near the Bedquilt entrance of Colossal Cave. Example 4 shows these descriptions at work in Giloogly's 1977 port of the Crowther/Woods source code.

Example 5. Crowther -- Bedquilt Entrance to Colossal Cave

Don Woods added rich layers of complexity and polish that turned Crowther's code from a brilliant idea into a finished game, but Crowther's humor, fantasy, combat and puzzles had already set a tone that would define the genre. In addition to the "Magic Word XYZZY" (see Example 5), players of Crowther's original game encountered belligerent dwarves, a surprisingly resourceful bird, a rusty metal rod with magical powers, and help text that announces "MAGIC IS SAID TO WORK IN THE CAVES." Since Woods never visited Colossal Cave, the new rooms and scenic elements he created (such as the underground volcano and the battery-dispensing vending machine) obviously reflect his own imagination, rather than the real subterranean landscape.



Map 2

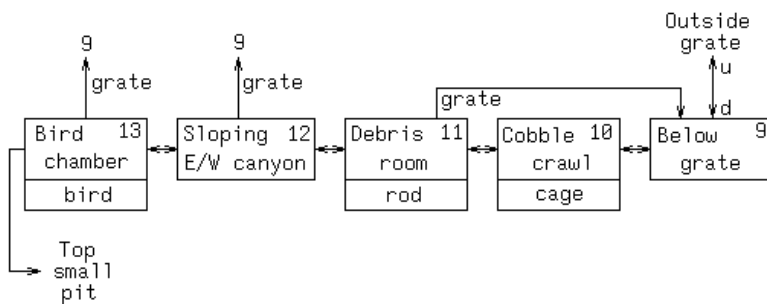


Figure 7. Cave Map [Crowther and Crowther 1975] compared to Toomey's Game Map [Toomey 1990]. How well does the geography of the real Colossal Cave (part of the Mammoth Cave System in southwestern Kentucky) match up with the map for Crowther's "Colossal Cave Adventure"? "Cave Map" (top) shows a detail from the Cave Research Foundation's map of the Bedquilt entrance to Colossal Cave. While Crowther simplified the layout for the game, reducing northwest zigs and southwest zags, and thus permitting the player to progress straight west from the entrance grate (marked with a boxed "X" in the lower right corner of the "CAVE MAP"), approximately the first half of the game is essentially faithful to the real cave.

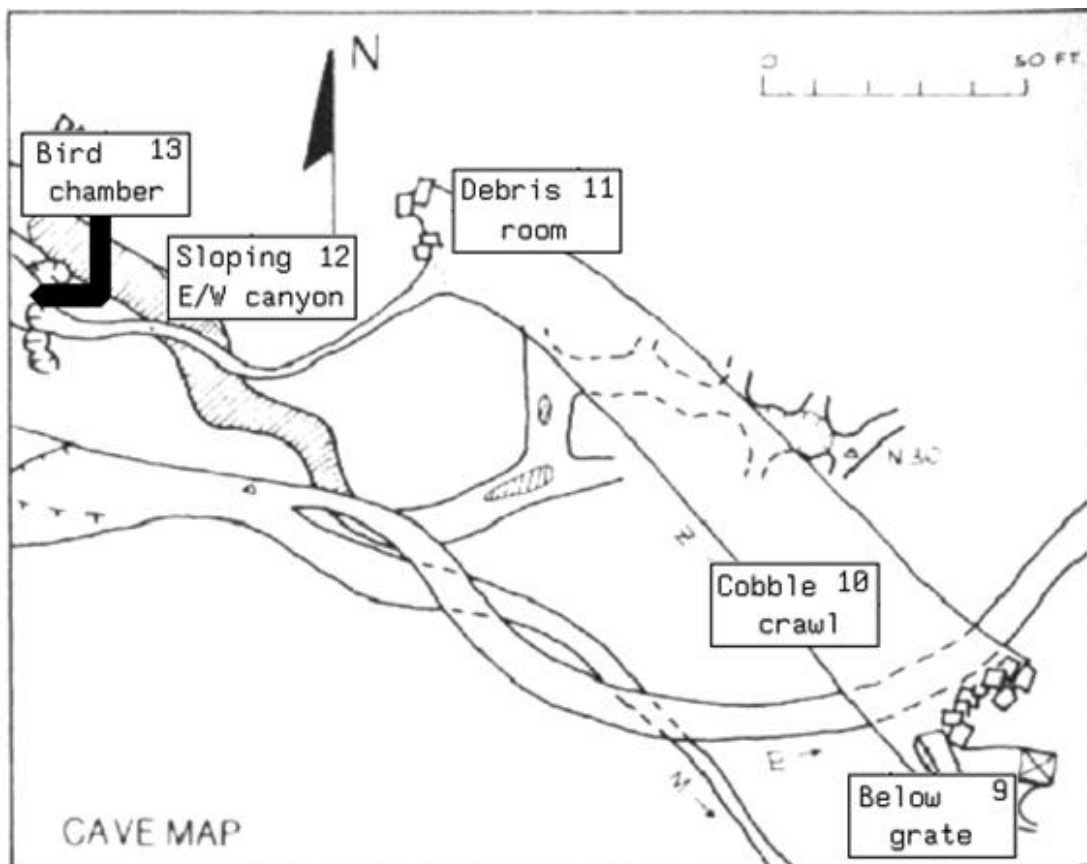


Figure 8. CRF-Toomey-Crowther Mashup.

9 YOU ARE IN A SMALL CHAMBER BENEATH A 3X3 STEEL GRATE TO THE
 9 SURFACE. A LOW CRAWL OVER COBBLES LEADS INWARD TO THE WEST.
 10 YOU ARE CRAWLING OVER COBBLES IN A LOW PASSAGE. THERE IS A
 10 DIM LIGHT AT THE EAST END OF THE PASSAGE.
 11 YOU ARE IN A DEBRIS ROOM, FILLED WITH STUFF WASHED IN FROM
 11 THE SURFACE. A LOW WIDE PASSAGE WITH COBBLES BECOMES
 11 PLUGGED WITH MUD AND DEBRIS HERE,BUT AN AWKWARD CANYON
 11 LEADS UPWARD AND WEST.
 11 A NOTE ON THE WALL SAYS "MAGIC WORD XYZZY".
 12 YOU ARE IN AN AWKWARD SLOPING EAST/WEST CANYON.
 13 YOU ARE IN A SPLENDID CHAMBER THIRTY FEET HIGH. THE WALLS
 13 ARE FROZEN RIVERS OF ORANGE STONE. AN AWKWARD CANYON AND
 A
 13 GOOD PASSAGE EXIT FROM EAST AND WEST SIDES OF THE CHAMBER.

Illustration: Crowther and Crowther's 1975 map of the Bedquilt region of Colossal cave, overlaid by elements from Toomey's game map (199x), above an excerpt from Table 1 of Crowther's FORTRAN source files (1976).

Photographic Walkthrough

Like the benevolent omniscient narrator of Victorian fiction, the narrator of "Adventure" — the "I" who answers the player's request for help — chooses to divulge certain details and withhold others. This characteristic of the game reflects the values of an experienced caver, who is typically reluctant to tell outsiders exactly where the entrances are: "They'll take a flashlight and a clothesline and one or the other will break or malfunction and then they'll die or have to be rescued, and you'll be responsible" [Cahill 2001]. For good reason, then, CRF members and National Park Service employees are reluctant to publicize the location of any undeveloped cave entrance.

The Bedquilt Rinky-Dink (Building and Forest)

Using a publicly-available map, the following details of the region were determined in 2004 by Mann:

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The (closed) road from the Collins House and the Austin house (now torn down) runs south about one mile to a public road. The Pumphouse was at the end of another closed road (not shown on my map) on the other side of that public road about one-half mile southwest at the Adwell Spring. The Bedquilt entrance is about another one-half mile southwest, downstream. The Colossal entrance is about one-half mile westnorthwest of the Bedquilt entrance, over the ridge. [Mann 2004]

Via MapQuest's "Place Name" feature, Adwell Spring is easily located as a site within Mammoth Cave National Park.

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Of the small brick building (which Crowther [Crowther 1976] describes as "A WELL HOUSE FOR A LARGE SPRING") built by the U.S. Park Service to house a pump that supplied water for visitors, only the foundation remains. While the Cave Research Foundation did not store supplies there, the "Adventure" player finds a bottle, a shiny brass lamp, tasty food, and keys inside.

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Figure 9. Foundation of the Building Featured in "Adventure". Cave Research Foundation members in Mammoth Cave National Park, Kentucky visit the remnants of the small brick building featured in the opening of "Colossal Cave Adventure." Dennis G. Jerz displays a water bottle, shiny brass lamp, and tasty food — items Crowther put there in the game. A fourth item — the key to the entrance gate -- is safely around the neck of party leader Dave West (seated in the background). (Room 2, "AT HILL IN ROAD") Photo by Lynn Brucker, © Cave Research Foundation 2005. Reproduced by permission.

According to the *Cave Research Foundation Personnel Manual* [Freeman 1975], the U.S. Park Service usually locks entrances to caves in Mammoth Cave National Park, and keys are issued to each small party of cavers [Freeman

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1975, 33]. The other items found in the building also hold a special significance within caving culture.

In the chapter entitled “Caving Equipment,” the handbook [*Cave Research Foundation Personnel Manual*] lists, among other items, “Food” (because cavers typically eat one or two meals on an expedition), a “Container for lamp water,” and “Metal carbide lamp.” Carbide is a substance that reacts with water to produce a flammable gas. Crowther supplied the game with a lamp, a bottle, and a source of water — but no carbide. Cave Research Foundation member Tom Brucker, who worked with the Crowthers on their intensive 1974 survey of Bedquilt, recalls that when he first played the game, he assumed the brass lantern would run out of carbide fuel, and assumed that winning the game would require finding a fresh supply....(It was Woods who supplied the “Adventure” lamp with a timer that warns the player that the lantern's power is running out, and who also added an underground vending machine — the source of fresh batteries.) Other items that are not implemented as objects in the game, but whose presence is implied, include a pack and a compass. The CRF manual offers a thoughtful soliloquy on the ideal proportions and strap configuration for a cave pack (26), and a whole chapter explains the proper use of a compass during a map-making survey. [Jerz and Thomas 2005]

Obviously enough, cavers use a bottle as a source of drinking water. Less obvious: cavers also use a bottle to carry their own waste water out of the cave.

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Difficulty in finding the cave entrance is often a significant part of a real visit to the Bedquilt region of Colossal Cave. According to a CRF trip report dated 30 Jun 1974, leader Richard Zopf and party members Pat and Will Crowther

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had trouble following the road in and cut down the valley early to find the entrance which was cleverly hidden by mud. Pat and Will scratched their heads and the sand alternately, and soon our shovel scratched the gate, about 1.5 feet down. It is, as one faces the hill, directly opposite the higher hole and next to the left bank. We cleaned the gate and got the old lock to open. The lock should be replaced with a Park service lock next trip. The new lock should be well-oiled. We relocked the gate, ascended the hill, and followed the road all the way back. The ticks were minimal. [Brucker, L. 2005]

In the game, the player can reach the entrance simply by going south from the pumphouse. But among cavers, an unsuccessful excursion to the Bedquilt entrance is a common experience known as “The Bedquilt Rinky-Dink.”

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Figure 10. Somewhere Nearby is Colossal Cave.

YOU ARE IN OPEN FOREST NEAR BOTH A VALLEY AND A ROAD. [Crowther 1976, Room 6]

THE TREES OF THE FOREST ARE LARGE HARDWOOD OAK AND MAPLE, WITH AN OCCASIONAL GROVE OF PINE OR SPRUCE. THERE IS QUITE A BIT OF UNDERGROWTH, LARGELY BIRCH AND ASH SAPLINGS PLUS NONDESCRITPT BUSHES OF VARIOUS SORTS. THIS TIME OF YEAR VISIBILITY IS QUITE RESTRICTED BY ALL THE LEAVES, BUT TRAVEL IS QUITE EASY IF YOU DETOUR AROUND THE SPRUCE AND BERRY BUSHES. (Table 6, Item 64)

Photo by Lynn Brucker, © Cave Research Foundation 2005. Reproduced by permission. The first CRF expedition to Colossal Cave in July of 2005 failed to locate the entrance. When asked, "What am I going to tell everyone when they ask me why we aren't just following the creek bed south from the pumphouse?", party members said the creek bed was too overgrown for easy travel. The next day, CRF cartographer Dave West led a successful trip.

Bedquilt Entrance



Figure 11. Colossal Cave Key.

YOU ARE IN A 20 FOOT DEPRESSION FLOORED WITH BARE DIRT. SET INTO THE DIRT IS A STRONG STEEL GRATE MOUNTED IN CONCRETE. A DRY STREAMBED LEADS INTO THE DEPRESSION. (Room 8, "YOU'RE OUTSIDE GRATE")

The horizontal gate no longer exists. This key opens the new vertical gate, which has been set up several hundred feet inside the cave entrance. Photo by Lynn Brucker, © Cave Research Foundation 2005. Reproduced by permission.



Figure 12. Bedquilt Entrance, 1994.

YOU ARE IN A SMALL CHAMBER BENEATH A 3X3 STEEL GRATE TO THE SURFACE. A LOW CRAWL OVER COBBLES LEADS INWARD TO THE WEST.
(Room 9, "YOU'RE BELOW THE GRATE")

In 1994, cavers cleared out the remnants of the concrete structure and the steel grate [NSS 1994]. Photo by Larry Matiz, 1994. Reproduced by permission.

The old horizontal gate and the concrete structure in which it was set were removed in 1994, according to the National Speleological Society. "Friday the entire Field Camp crew went to the Bedquilt Entrance to remove the debris from that project. This consisted of the old gate, a steel monster that took four people to haul up the hill, the broken concrete from the former gate base and the tools used on the project. We formed a chain gang part of the way up the hill and passed the broken concrete from person to person.... The debris was loaded into a waiting trailer and removed from the area. "



Figure 13. Using the Bedquilt Entrance. In 2005, the Bedquilt entrance to Colossal Cave was a tight squeeze. Photo by Lynn Brucker, © Cave Research Foundation 2005. Reproduced by permission.



Figure 14. Looking Out the Bedquilt Entrance to Colossal Cave. Photo by Lynn Brucker, © Cave Research Foundation 2005. Reproduced by permission.

Cobble Crawl to Debris Room



Figure 15. Low Crawl over Cobbles.

YOU ARE CRAWLING OVER COBBLES IN A LOW PASSAGE. THERE IS A DIM LIGHT AT THE EAST END OF THE PASSAGE. (Room 10, "YOU'RE IN COBBLE CRAWL.")

This passage stretches northwest for hundreds of feet, often with less than a foot of clearance. It is possible to push the cobbles aside in order to make more headroom, so the real site is not quite as claustrophobic as the photo might appear. In the game, progress beyond this point is impossible without the lamp. Photo by Lynn Brucker, © Cave Research Foundation 2005. Reproduced by permission.

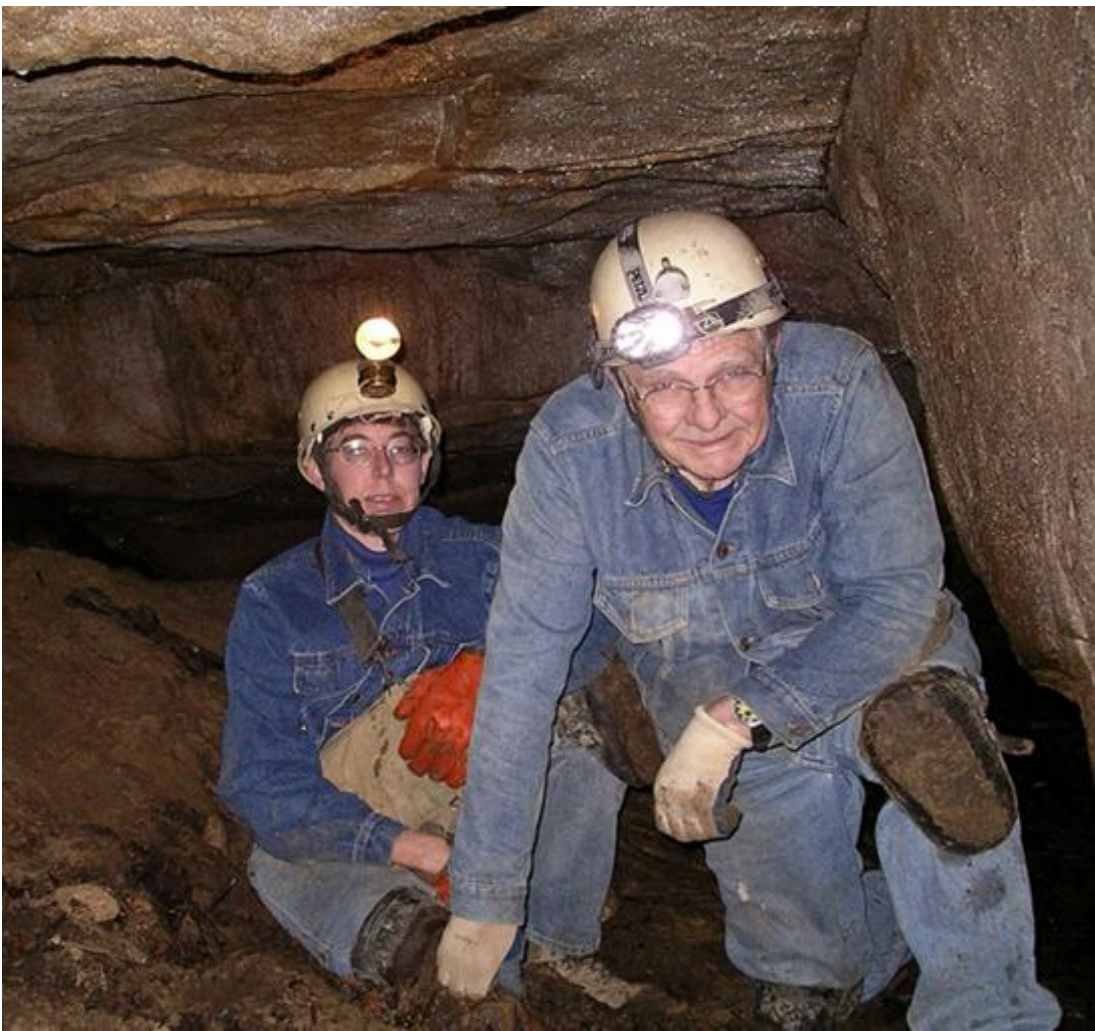


Figure 16. “MAGIC WORD XYZZY”.

YOU ARE IN A DEBRIS ROOM, FILLED WITH STUFF WASHED IN FROM THE SURFACE.... A NOTE ON THE WALL SAYS “MAGIC WORD XYZZY”. (Room 11, “YOU’RE IN DEBRIS ROOM.”)

Cave Research Foundation members Lynn Brucker and Roger Brucker crouch beside the wall that many cavers believe Will Crowther was thinking of when he put the “XYZZY” message into “Adventure.” Photo by Dennis G. Jerz, © Cave Research Foundation 2005. Reproduced by permission.

In a telephone interview, Crowther’s sister Betty Bloom, who was one of the original play-testers of “Adventure”, shared an anecdote: “I was bored having to go through all the steps every time, and I said, ‘I want to go directly into the game.’ [Dramatic pause.] ‘Ecks-why-zee-zee-why!’ ” [Bloom 2002]. Crowther confirmed this detail about the word, which teleports the player to and from the small building: “Betty was correct that I created it for her - she is an impatient sort, and wanted a shortcut. I figured why not, there are lots of impatient people out there who would appreciate a shortcut” [Bloom 2002]. According to Bloom, “XYZZY” was a family password. “If the kids ever got lost in an airport, and they ever had to verify who they were, we would just ask them for a magic word, and it would be XYZZY.” While Crowther states that “XYZZY was not a family password - I made it up out of whole cloth just for the game,” we may imagine that *other* family members used it as a password, *after* Crowther invented it for the game. In telephone interviews, Bloom and Crowther’s daughters all spelled out the letters in the word, but they report that Crowther himself pronounced it “zizzy.” According to Crowther (2007), “Magic words should look queer, and yet somehow be pronounceable - XYZZY seemed pretty good that way. I was considering working for XEROX at the time, which probably suggested starting with an X.” [Crowther 2007] Asked about Hunsinger’s observation that XYZZY is “a mnemonic device to remember how to do cross products” [Adams 2007b], Crowther replied, “I’ve never heard that math mnemonic.”



Figure 17. Silt-filled Canyon.

YOU ARE IN AN AWKWARD SLOPING EAST/WEST CANYON. (Room 12.)

In caver terminology, a "canyon" is any passage that is taller than it is wide. This passage still slopes, but has silted up considerably since Crowther knew it. Photo by Lynn Brucker, © Cave Research Foundation 2005. Reproduced by permission.



Figure 18. New Vertical Gate.

THE GRATE IS NOW UNLOCKED. (Table 6, Item 37)

Instead of the horizontal 3x3 horizontal grate described in "Adventure", the Bedquilt entrance to Colossal Cave is now protected by a vertical gate, which in this photograph lies open on the ground (away from the camera). A spray can of oil is stored on a rock nearby. Photo by Lynn Brucker, © Cave Research Foundation 2005. Reproduced by permission.

Bird Chamber to Hall of Mists

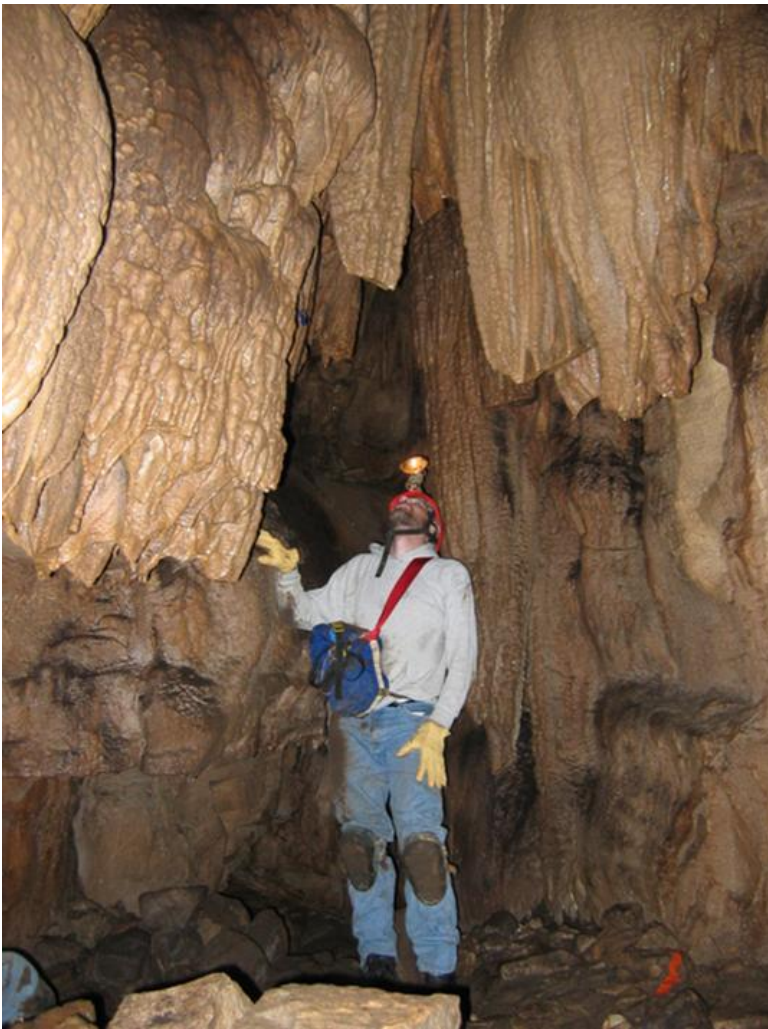


Figure 19. Cave Formations.

YOU ARE IN A SPLENDID CHAMBER THIRTY FEET HIGH. THE WALLS ARE FROZEN RIVERS OF ORANGE STONE. AN AWKWARD CANYON AND A GOOD PASSAGE EXIT FROM EAST AND WEST SIDES OF THE CHAMBER. (Room 13, "YOU'RE IN BIRD CHAMBER.")

Photo by Lynn Brucker, © Cave Research Foundation 2005. Reproduced by permission.

While Woods retained the name "Bird Chamber," many later versions of "Adventure" present this room as "Orange River Chamber." No birds are likely to be found singing this deep in the cave, but the cave formations here do resemble a certain prop associated with the bird.



Figure 20. Birdcage?

A CHEERFUL LITTLE BIRD IS SITTING HERE SINGING (Table 5, Item 7)

THERE IS A SMALL WICKER CAGE DISCARDED NEARBY. (Table 5, Item 204)

Could this formation in the "Bird Chamber" (where the player encounters a cheerful, and eventually helpful, bird) have given Will Crowther the idea to include a birdcage (which the player finds nearby in the Cobble Crawl)? Photo by Dennis G. Jerz, © Cave Research Foundation 2005. Reproduced by permission.



Figure 21.

A THREE FOOT BLACK ROD WITH A RUSTY STAR ON AN END LIES NEARBY
(Table 5, Item 205)

It is not quite three feet long, there is no sign of the star, and when this photo was taken it was in "Top of Small Pit" rather than the "Debris Room" where Crowther placed it. But there is a rusty rod in the real Colossal Cave. A star-less "THREE FOOT BLACK ROD WITH A RUSTY MARK ON AN END" was added by Woods. Photo by Lynn Brucker, © Cave Research Foundation 2005. Reproduced by permission.



Figure 22. Looking down from "Top of Small Pit".

AT YOUR FEET IS A SMALL PIT BREATHING TRACES OF WHITE MIST. AN EAST PASSAGE ENDS HERE EXCEPT FOR A SMALL CRACK LEADING ON. (Room 14, "YOU'RE AT TOP OF SMALL PIT")

Photo by Lynn Brucker, © Cave Research Foundation 2005. Reproduced by permission.



Figure 23. In the "Hall of Mists," looking up towards "Top of Small Pit." Coming down is much easier than going up. Park (1994) describes the passage as "more difficult than just typing 'up' or 'down' at your computer terminal. At the top of it, you are stretched all the way out, pressing against the other wall with outstretched legs, while fervently searching for a place to put your butt or back in order to support your weight." Photo by Dennis G. Jerz, © Cave Research Foundation 2005. Reproduced by permission.



Figure 24. Hall of Mists.

YOU ARE AT ONE END OF A VAST HALL STRETCHING FORWARD OUT OF SIGHT TO THE WEST. THERE ARE OPENINGS TO EITHER SIDE. NEARBY, A WIDE STONE STAIRCASE LEADS DOWNWARD. THE HALL IS FILLED WITH WISPS OF WHITE MIST SWAYING TO AND FRO ALMOST AS IF ALIVE. A COLD WIND BLOWS UP THE STAIRCASE. THERE IS A PASSAGE AT THE TOP OF A DOME BEHIND YOU. (Room 15, "IN HALL OF MISTS")

Photo by Lynn Brucker, © Cave Research Foundation 2005. Reproduced by permission.



Figure 25.

YOU ARE ON THE EAST BANK OF A FISSURE SLICING CLEAR ACROSS THE HALL. THE MIST IS QUITE THICK HERE, AND THE FISSURE IS TOO WIDE TO JUMP. (Room 17, "ON EAST BANK OF FISSURE.")

A CRYSTAL BRIDGE NOW SPANS THE FISSURE. (Table 5, Item 112)

Crowther invented a fissure which blocks the player's progress. The magical appearance of the crystal bridge is one of Crowther's departures from reality, and further evidence that his original version of "Adventure" was a game with fantasy elements, even before Don Woods expanded, polished, and re-released it. If these long stone slabs were not in the real cave, it would still be possible to traverse the hall by walking across rubble; but passage would be much slower. The magic crystal bridge likewise speeds the player's progress through the game, even though it is possible to get to the other side of the hall without conjuring up the bridge. Photo by Lynn Brucker, © Cave Research Foundation 2005. Reproduced by permission.



Figure 26.

THIS IS A LOW ROOM WITH A CRUDE NOTE ON THE WALL. IT SAYS "YOU WON'T GET IT UP THE STEPS". (Room 18, "YOU'RE IN NUGGET OF GOLD ROOM.")

THERE IS A LARGE SPARKLING NUGGET OF GOLD HERE! (Table 5, Item 210)

A thorough search of a small room south of the Hall of Mists yielded neither note nor nugget, but perhaps that was due to a sputtering headlamp. Photo by Lynn Brucker, © Cave Research Foundation 2005. Reproduced by permission.



Figure 27. YOU HAVE NO SOURCE OF LIGHT. Table 6, Item 38. Battery-powered lights were cumbersome and inefficient in the 1970s. The brass lamps that were the favored light source contain water in the upper chamber, which drips slowly into a lower chamber filled with calcium carbide. The resulting chemical reaction produces acetylene gas, which burns with a very clean flame. While some modern cavers prefer battery-powered LEDs, carbide lamps remain popular among traditionalists — in part because caves are chilly and the open flame is a convenient source of warmth. Aesthetically, the brass reflector makes the orange flame seem even warmer; but more important, the brass fixtures will not interfere with a delicate compass needle. Photo by Dennis G. Jerz, © Cave Research Foundation 2005. Reproduced by permission.



Figure 28. There are in fact some old discarded batteries in the Hall of Mists. While modern cavers are expected to bring all of their own trash with them, these items are considered historical artifacts. Woods added a timer to the headlamp, and a vending machine to dispense fresh batteries. While Crowther wrote his game at a time when carbide lanterns were more reliable than battery-powered lights, his original source code does include the command "RUB," which yields the response "RUBBING THE ELECTRIC LAMP IS NOT PARTICULARLY REWARDING. ANYWAY, NOTHING EXCITING HAPPENS." Thus, Woods was following Crowther's lead when he implemented the light source as electric. Photo by Lynn Brucker, © Cave Research Foundation 2005. Reproduced by permission.



Figure 29. THERE IS A LITTLE AXE HERE (Table 5, Item 221).

A LITTLE DWARF JUST WALKED AROUND A CORNER, SAW YOU, THREW A LITTLE AXE AT YOU WHICH MISSED, CURSED, AND RAN AWAY. (Table 6, Item 3)

A diminutive cave dweller examines an old axe head, located in the Hall of Mists. Photo by Dennis G. Jerz, © Cave Research Foundation 2005. Reproduced by permission.

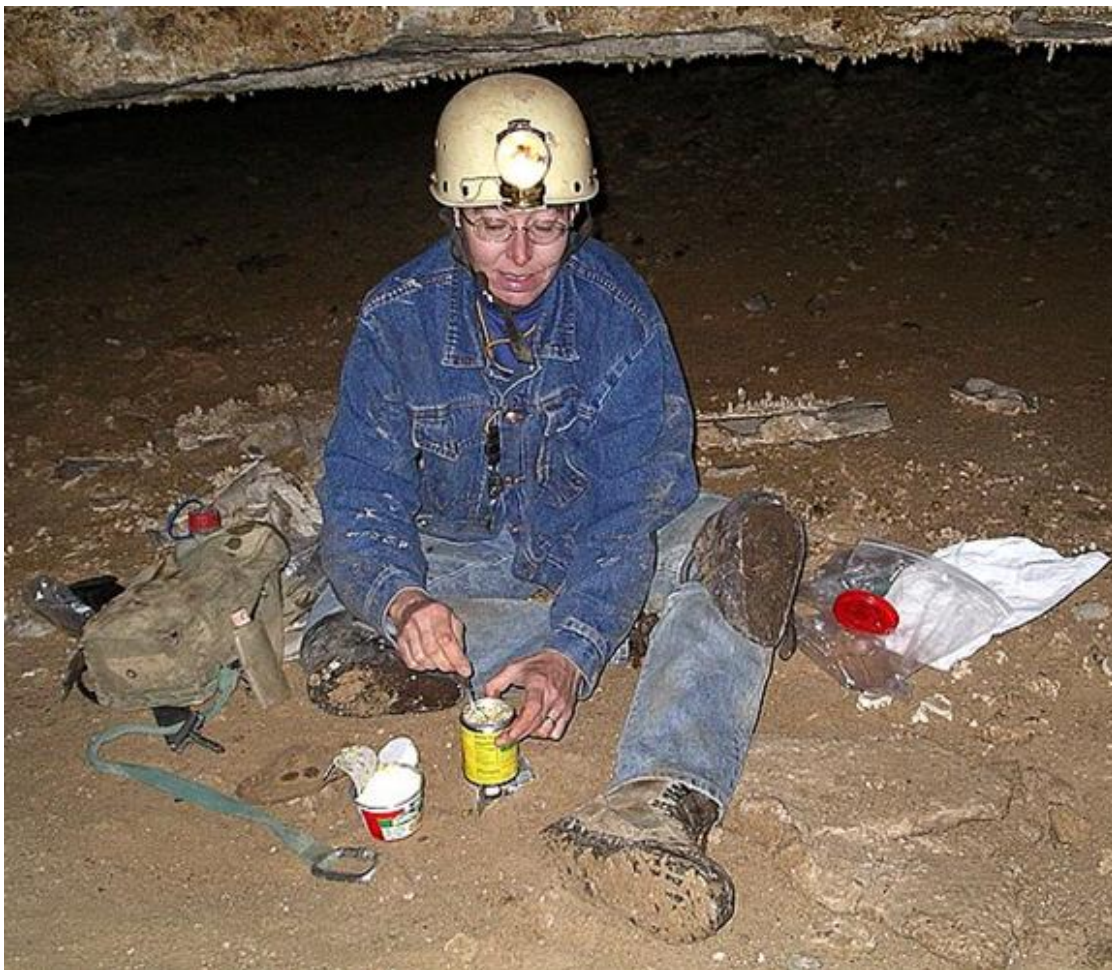


Figure 30. Stopping for a leisurely lunch in the Hall of Mists.

THERE IS FOOD HERE. (Table 5, Item 221)

The temperature in Colossal Cave is about 53 degrees, so a hot meal is welcome. Lynn Brucker has eaten a can of fruit, poured a microwaveable container of noodles into the fruit can, and is now heating the noodles over the flame of a tiny stove. Plastic baggies keep dirt away from napkins, utensils, and camera lenses. Photo by Dennis G. Jerz, © Cave Research Foundation 2005. Reproduced by permission.



Figure 31. Wide Stone Staircase.

NEARBY, A WIDE STONE STAIRCASE LEADS DOWNWARD. (Room 15, "YOU'RE IN HALL OF MISTS")

Caver terminology often employs architectural metaphors. For instance a "room" is any discrete space, no matter the shape; a "hall" is any long space, a "chimney" is a pit when seen from below, and a "dome" is the roof of a pit. There really is a wide staircase (pictured here) leading down from the Hall of Mists to the Hall of the Mountain King. There are also "ROUGH STONE STEPS" leading down from "At Top of Pit," and they are now very rough indeed (see Figure 23). According to CRF members, the steps date from a time before the Park Service took over the site, when a private owner was developing it for tourism. Photo by Lynn Brucker, © Cave Research Foundation 2005. Reproduced by permission.

A Maze of Twisty Little Passages, All Alike

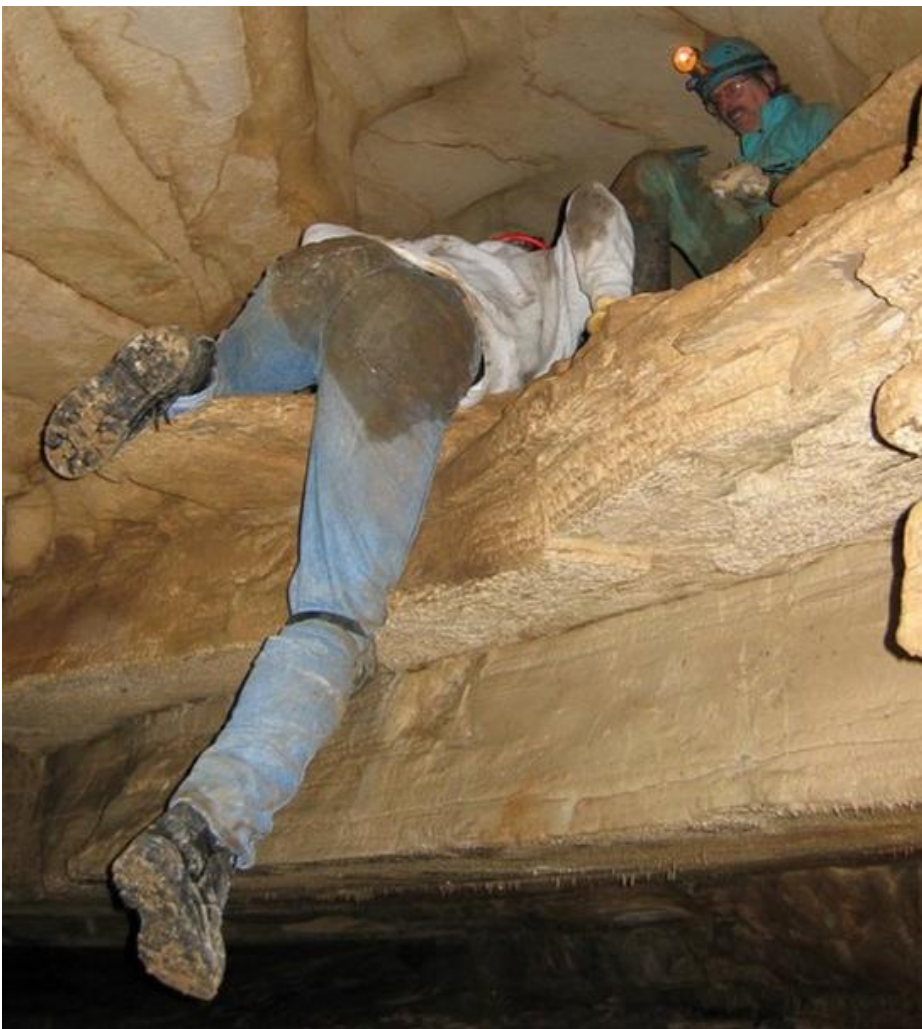


Figure 32.

YOU ARE AT THE WEST END OF HALL OF MISTS. A LOW WIDE CRAWL CONTINUES WEST AND ANOTHER GOES NORTH. TO THE SOUTH IS A LITTLE PASSAGE 6 FEET OFF THE FLOOR. (Room 41, "YOU'RE AT WEST END OF HALL OF MISTS.")

Photo by Lynn Brucker, © Cave Research Foundation 2005. Reproduced by permission.



Figure 33.

YOU ARE IN A MAZE OF TWISTY LITTLE PASSAGES, ALL ALIKE. (Rooms 42, 43, 44, 45, 49, 50, 51, 52, 53, and 55.)

Party leader Dave West points out one of several potential ways to get lost in the location that inspired the most infamous of all game mazes. Photo by Dennis G. Jerz, © Cave Research Foundation 2005. Reproduced by permission.

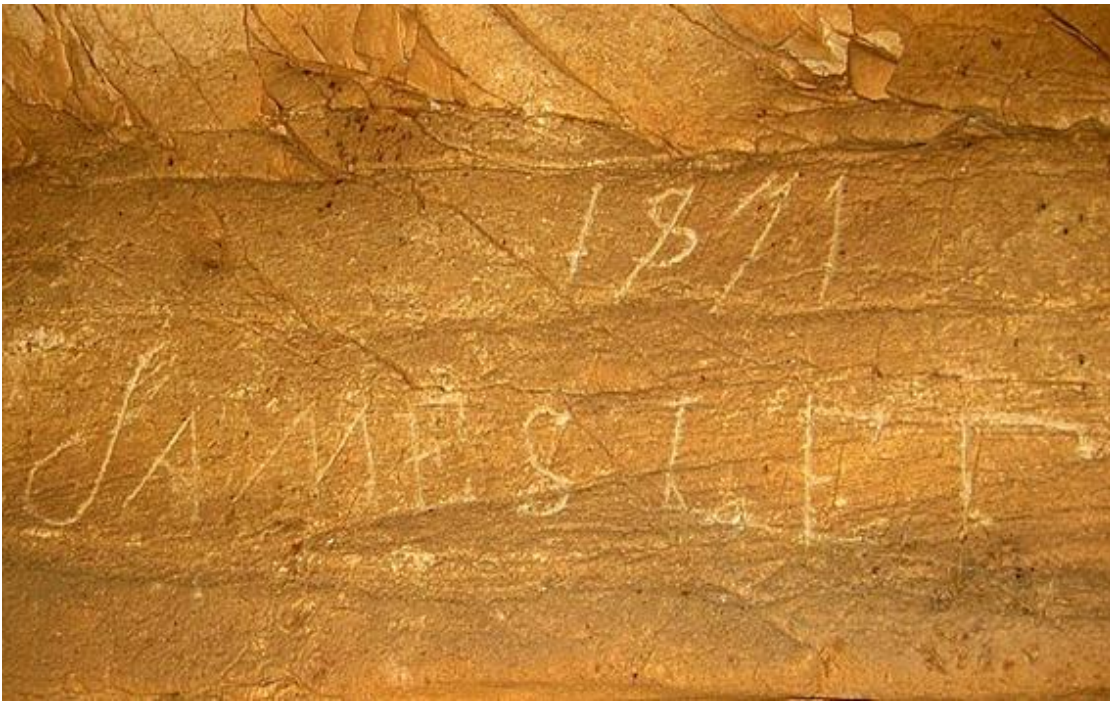


Figure 34. Text Adventures in Colossal Cave. Serious modern cavers frown on permanently defacing cave features with graffiti, but some cavers do document and learn from these testaments to the achievements of previous cavers. Among the forms of annotation often spotted during this trip were painted survey dots (see the bright orange stripe, visible on a rock on the lower right of Figure 19), sooty marks made with burning lamp tips, and small cards bearing directional information (one is visible in Figure 21, near the base of the rod). Photo by Dennis G. Jerz, © Cave Research Foundation 2005. Reproduced by permission.



Figure 35.

THE LITTLE BIRD IS NOW DEAD. ITS BODY DISAPPEARS. (Table 6, Item 45)

A rock cairn marks the skeleton of a small visitor defeated by the maze of twisty little passages. Photo by Dennis G. Jerz, © Cave Research Foundation 2005. Reproduced by permission.

You're At Y2... A Hollow Voice Says "PLUGH"



Figure 36.

YOU ARE IN A LARGE ROOM, WITH A PASSAGE TO THE SOUTH, A PASSAGE TO THE WEST, AND A WALL OF BROKEN ROCK TO THE EAST. THERE IS A LARGE "Y2" ON A ROCK IN ROOMS CENTER. (Room 33, "YOU'RE AT Y2")

A HOLLOW VOICE SAYS "PLUGH" (Table 6, Item 8)

In "Adventure", entering the command "PLUGH" from this location transports the player to the small building.
 [19] **Jerz:** "All right, well here I am underground with Dave West, Roger Brucker and Lynn Brucker at Y2. Dave, what would you say we're supposed to say at this point?" **West:** "Well... I've tried many ways to pronounce it. Plug, ploog, ploof, pluh. And I'm still here." **R. Brucker:** "'PLUGH!!'" **Jerz:** "That didn't sound too hollow. It sounded... something. " Photos by Lynn Brucker and Dennis G. Jerz, © Cave Research Foundation 2005. Reproduced by permission.

Another of the commonly-repeated memes about Colossal Cave describes Y2 as "a common notation on maps denoting a secondary entrance" [Adams 2007a]. CRF members say that it is merely a label given to a survey station, the second in a series of points along a survey route that happened to use the letter Y. A CRF trip report dated November 1974 indicates that Crowther led a team that began the Y survey in the Bedquilt area of Colossal Cave [Brucker, L. 2005]. While there are other entrances to Colossal Cave, there is no such entrance near "YOU'RE IN Y2." While Y2 is the only survey code mentioned in the game, in the real cave, similar alphanumerical marks are often spotted (see Figure 25, on one of the slabs occupying the space where Crowther put the crystal bridge).

At Window on Pit

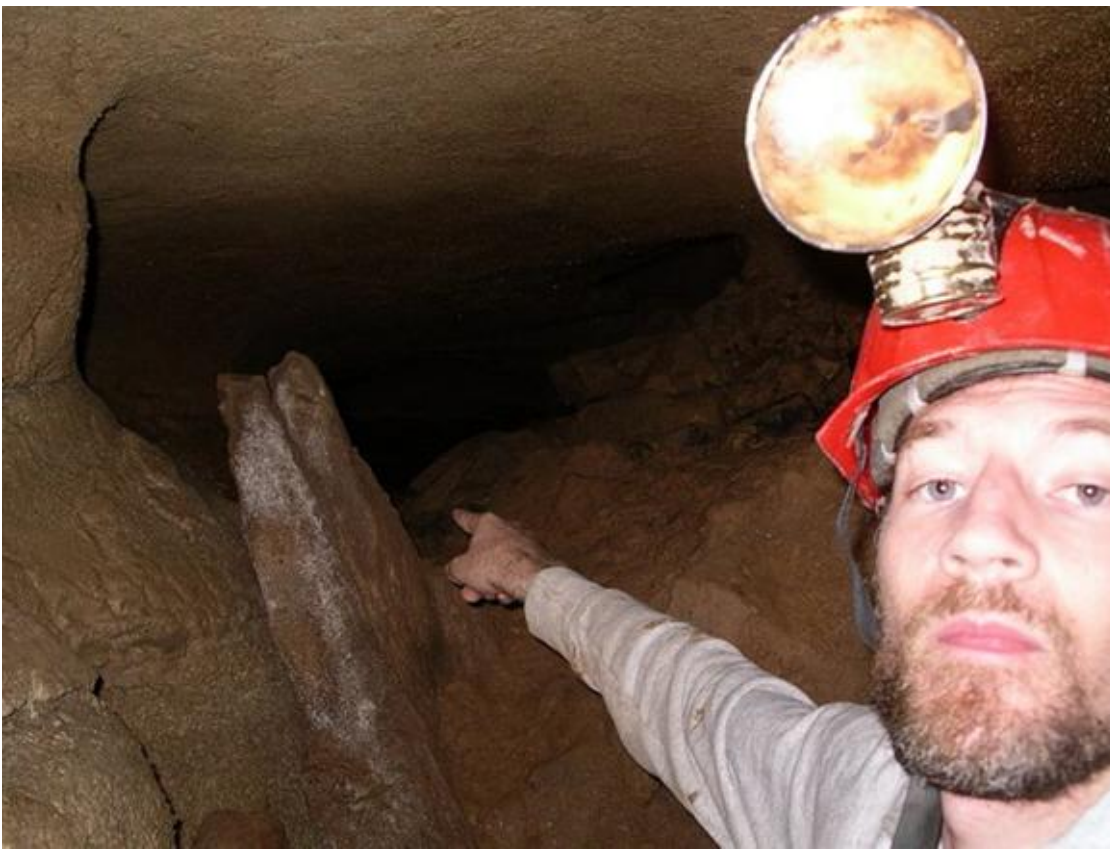


Figure 37. A Caving Theorist Contemplates Applied Speleology.

...OTHERS HAVE FOUND FORTUNES IN TREASURE AND GOLD, THOUGH IT IS RUMORED THAT SOME WHO ENTER ARE NEVER SEEN AGAIN. (Table 6, Item 1)

Photo by Dennis G. Jerz, © Cave Research Foundation 2005. Reproduced by permission.

The party's computer game specialist must have seemed reasonably competent during his first attempt at applied caving. After bringing the party to the Y2 junction, leader Dave West pointed to a tiny opening five feet off the ground — about a foot high and two feet wide — and said, “Go that way.”

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It is one thing to squirm through a tight passage when one can always see several people ahead, silhouetted against the lighted walls. It is a much more stressful experience to plunge ahead towards the darkness that lurks, grue-like, beyond the flickering edges of sight. The roof of the narrow passage opened up before long, and then the bottom dropped away. The destination turned out to be what Crowther called Room 35, “Window on Pit” (see Figure 38), “WHICH GOES UP AND DOWN OUT OF SIGHT.” (Figures 39, 40). Woods created a second room (#110) with the same name, and also created a shadowy figure who waves back at you from a lighted window on the other side of the pit. While the bottom of the pit is only implied in Crowther's game, Woods implemented it as follows:

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SUSPENDED FROM SOME UNSEEN POINT FAR ABOVE YOU, AN ENORMOUS TWO-SIDED MIRROR IS HANGING PARALLEL TO AND MIDWAY BETWEEN THE CANYON WALLS. (THE MIRROR IS OBVIOUSLY PROVIDED FOR THE USE OF THE DWARVES, WHO AS YOU KNOW, ARE EXTREMELY VAIN.) A SMALL WINDOW CAN BE SEEN IN EITHER WALL, SOME FIFTY FEET UP.

(Woods's Room 109, “YOU'RE IN MIRROR CANYON.”) This riff on Crowther's original geography, and the off-beat approach to the setting, is a typical example of Woods's tendency to introduce a comic tension within the spirit of Crowther's original.



Figure 38.

YOU ARE AT A WINDOW ON A HUGE PIT, WHICH GOES UP AND DOWN OUT OF SIGHT. A FLOOR IS INDISTINCTLY VISIBLE OVER 50 FEET BELOW. DIRECTLY OPPOSITE YOU AND 25 FEET AWAY THERE IS A SIMILAR WINDOW. (Room 35, "YOU'RE AT WINDOW ON PIT")

In caving terminology, a horizontal passage makes a "window" when it intersects with a larger vertical shaft. Photo by Lynn Brucker, © Cave Research Foundation 2005. Reproduced by permission.



Figure 39. Composite photo showing the view across pit. A composite view of the “window” across the shaft, as seen from the vantage point of the window in Figure 38. (Room 35, “YOU'RE AT WINDOW ON PIT”.) Photo by Dennis G. Jerz, © Cave Research Foundation 2005. Reproduced by permission.



Figure 40. Looking down from "Window on Pit". A ledge visible in the upper right of this image is the same ledge seen in the bottom center of Figure 39. Photo by Dennis G. Jerz, © Cave Research Foundation 2005. Reproduced by permission.

At Brink of Climbable Pit



Figure 41. Mist at the Brink of Climbable Pit.

YOU ARE ON THE BRINK OF A SMALL CLEAN CLIMBABLE PIT. A CRAWL LEADS WEST. (Room 37)

MIST IS A WHITE VAPOR, USUALLY WATER, SEEN FROM TIME TO TIME IN CAVERNS. IT CAN BE FOUND ANYWHERE BUT IS FREQUENTLY A SIGN OF A DEEP PIT LEADING DOWN TO WATER. (Table 6, Item 69)

Photo by Lynn Brucker, © Cave Research Foundation 2005. Reproduced by permission.



Figure 42. Telling stories at Brink of Climbable Pit before the return trip.

SORRY, BUT I AM NOT ALLOWED TO GIVE MORE DETAIL. I WILL REPEAT THE LONG DESCRIPTION OF YOUR LOCATION. (Table 6, Item 15)

. Photo by Dennis G. Jerz, © Cave Research Foundation 2005. Reproduced by permission.

Cavers have a wry sense of humor and an easy communal nature. While mountain climbers who pause to rest before making the return trip can focus on the view, the CRF members faced each other and swapped stories at “AT BRINK OF CLIMBABLE PIT.” When it was time to go, West turned to the newest member of the party — a caving theorist who often has trouble finding his car in the faculty parking lot — and said, “You’re going to lead us out.”

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And he was serious.^[20]

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Cavers Reflect on “Adventure”

Crowther’s ex-wife Patricia Wilcox did not play or even know about the original version of the game. She recalls a CRF meeting in “1976 or 77” in which many members who had ostensibly come to Boston for a weekend of mapping instead spent hours playing the Crowther/Woods “Adventure.” She described the geography of the game as “Completely different from the real cave. It used names that we made up,” though her assessment is likely influenced by the sections added by Woods. According to Crowther (2001), “the geometry [of the game] was lifted directly from Bedquilt Cave.”

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Other cavers have reported that the geography of the game closely matches the geography of the cave. For example, Park (1994) reports that an “Adventure” fan and novice caver, Bev Schwartz, knew the game so well that, on her first trip into the real cave, “We would be at a junction and she would ask compass directions and then begin to tell us what was down this passage or the other – all correctly!” Park also offers an anecdote of a party’s encounter with a real snake while climbing up into the Bird Chamber (see Figures 21, 22, 23): “[O]ne party member, Roger, noticed to his horror a copperhead snake (was it THE SNAKE?) on the ledge next to his right hand.... Confronted by the snake, Roger was so beside himself that all he could do was yell ‘Strike, strike’ as the copperhead proceeded to do just that. Tom, the party leader, had already made the climb up (and not seen the snake). Looking around for something to do, he found a

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stick (was it the MAGIC WAND?), in the Bird Chamber (the room with the rivers of orange stone, actually a beautiful column of orange travertine). Wand in hand, he moved the snake away.”

Park's references to a snake and rod illustrate the general opinion among cavers that Crowther's cave and game are very closely connected. Nevertheless, Crowther did make certain deliberate changes when he created the game. For instance, he invented the fissure that blocks the player's progress at the Hall of Mists. Tom Brucker, who caved with the Crowthers while they were mapping the site, reports that in order to create the crystal bridge puzzle,^[21] Crowther edited out a passage that would have enabled an easy bypass.

Will never liked that passage, even though it loops back to the Hall of the Mountain King....Will based the game on what we purposely called “The Bad map of Bedquilt” ... a very quick, [albeit] elegant, map that challenged us during the Bedquilt project to fill in the missing parts. There were plenty of parts missing.
[Brucker, T. 2005a]

When asked what elements of Crowther's personality he finds in the game, Brucker stated that Crowther is the sort of person who would say, “You want to see how clever I am? I took your 300 lines of code, and I reduced it by 47%. He didn't set out to *be* clever. [He would say] Let's set out to make some puzzle and see if someone can solve it. It really reflects his nature.... I think he's that little dwarf, throwing the axe at you. He won't leave you alone. Whoosh! Come on. Figure it out!” [Brucker, T. 2005a]

Adjusting the Adventure Timeline

Numerous timelines of computer and gaming history and multiple sources report that Crowther's original game was abandoned as early as 1972, and that Woods released his updated version in 1976. Both dates are incorrect.

The false date of 1972 has attracted many compilers of timelines and internet histories, possibly because it is the date the former Patricia Crowther traversed a tight passage between two networks of caves previously thought to have been unconnected — an event that marks the climax of Brucker and Watson's *The Longest Cave* (1976). Interviews with Crowther and his family members (sister, two children, and ex-wife) all confirm that the game was created shortly after the divorce, which they all say happened in mid-1975 [Crowther 2001]; [Bloom 2002]; [Carter 2002]; [Lawrence 2002]; [Wilcox 2002]. Betty Bloom, Crowther's sister, recalls spending her sabbatical with Crowther during the time he created the game, and was a regular playtester. According to Bloom's records, that sabbatical took place during the academic year of 75-76. In separate telephone interviews, Crowther's children Sandy (born in 1967) and Laura (born in 1970) recall being eight and “less than six,” respectively, when they first played the game, during a school vacation when they were staying with their father. Crowther (2001) recalls creating “Adventure” over a period of several weekends; likewise, his daughters recall watching the game develop across a span of several different school vacations. None of the family members remembers which school vacations were involved. Bloom and Sandy both indicate Laura had already turned six, which would place the creation of “Adventure” after Laura's sixth birthday (in January of 1976). According to Laura: “I think 1972 is early -- I would have been two.”

When asked what her father thought of Woods's expansion, Laura (who became a middle-school science teacher) said, “I remember being extremely irritated by things like the pirate, and Dad saying not to blame *him*, it wasn't his fault!” Sandy (who became a Sun Solaris administrator) has vivid memories of being “addicted” to playing the Crowther/Woods version when she was older; as a child, she remembers mostly being frustrated by her father's version. When asked about her father's reaction to Woods's expansions, she recalled: “I got stuck with, ‘Kill dragon.’ ‘What with, your bare hands?’ You have to say, ‘yes.’ I remember my father saying, ‘That was Don Woods.’ ”

All Crowther family testimony is consistent with the 1975-76 date range. Responding to a direct request via e-mail, Crowther (2001) dated his original “Adventure” to 1975, “give or take a year.” Certainly Crowther had stopped working on the game by the time Woods contacted him (by sending an e-mail to “crowther” at every domain name in existence at the time). Woods, in early interviews, gave March or April of 1976 as the date he released his expansion; but after examining backup files from his Stanford student account, he now says (2007) his estimate was off by a year, because the oldest relevant files in Woods's student account (likely representing when Woods started on the code, not when

Crowther stopped) bear the date March 11, 1977. Gilbert (one of Woods's Stanford classmates) had written "I'm pretty certain it was between October and December 1975 when Don and I first ran across it" [Gilbert 2005], which supports Laura's memory of being "less than six" and thus makes a plausible case for 1975; nevertheless, when informed that Woods now uses the 1977 figure, Gilbert also suggested that 1975 may be "off by a year" [Gilbert 2007]. The most likely timeline places Crowther ceasing work on his original game in early 1976.

This new timeline results in an even faster trajectory for key events in the advance of the new genre. Crowther's memory [Hafner 1994] of "Adventure" having gained a following a month after he put the program on his BBN account and left for a vacation is supported by the fact that one of these early fans brought it to a Stanford computer, where Woods encountered it. Some time before March 11, 1977, Woods contacted Crowther, who gave him access to the source code. By March 23, we see in Woods's records a version with some 20 additional lines of code — a low-level subroutine that Woods supplied in order to get the source to compile. The March 31 set of files again show only minor tweaks. The evidence demonstrates Woods was working on Crowther's source code during March, but during that month we see no evidence of Woods's creative expansions.

Woods must have been very busy during April. By mid-May, hackers at MIT had noticed the game. After they solved it, "the true lunatics began to think about how they could do it better" [Anderson 1985], and by June, "Zork" had already taken recognizable form. When one considers that this pioneering work on text adventure games was happening during a time span which includes the May 25 release of *Star Wars* and the June 5 sale of the first Apple computers, it is not likely that any other similar time span has encompassed so many seminal events in geek culture.

Conclusions

The research expedition to the real Colossal Cave in Mammoth Cave National Park confirms that the map of Will Crowther's original "Adventure" closely follows the geography of the real cave, but with fantasy and puzzle elements. The original source code shows that Crowther selectively deviated from realism; the tension between the altered geography and the mostly naturalistic text illustrates Crowther's respectful intimacy with the natural wonders of Colossal Cave. Woods added complexity and polish, with a careful eye for improving the user's experience (and, occasionally, proofreading). His contributions more than doubled the size of the original data file (from 728 lines to 1809) and more than quadrupled the size of the code file (from 709 lines to 2949). When expanding the geography, Woods improvised freely, yet his additions form an agreeable tension with Crowther's naturalistic setting.

Relevant details from caving culture which offer insights into "Adventure" include artifacts in the real "Colossal Cave," such as an axe head and a rusty iron rod; human alterations to the natural cave, such as carved stone steps and a locked iron gate; natural geographic features, such as the striking formations of orange rock and the huge stone slabs occupying the space where a magical bridge appears in the game; and newly-assembled evidence of Crowther's activities in Colossal Cave, including Cave Research Foundation maps and trip reports. This evidence demonstrates the extent to which Crowther's familiarity with the real cave provided inspiration for a genre-defining new form of artistic expression.

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Notes

[1] Montfort (2003) aptly traces the precursors to "Adventure", such as "ELIZA", "SHURDLU", and "Hunt the Wumpus" (the latter of which was also set in a cave).

[2] The term *interactive fiction* has also been applied to hypertext literature [Howell and Douglas 1990], AI-based character simulations [Anderson and Holmqvist 1990], and, sporadically, as a synonym for “alternate reality” or “viral marketing” games [McGonigal 2008, 6] and <http://www.immersivegaming.com>); however, in this paper, “interactive fiction” applies only to the genre of command-line text games patterned after “Adventure”.

[3] See Jerz 2002, and particularly the note on Packard, E. “Interactive Fiction for Children: Boon or Bane?”, *School Library Journal* 34 (1987): 40-1.

[4] Crowther's older daughter Sandy Lawrence (2002) ponders her father's fame: “It's funny thinking of him as the J. D. Salinger of interactive fiction... to me, he's just my dad.”

[5] While some scholars use italics for titles of computer games, and while the popular gaming press often does not mark game titles in any way, this study will format the title of “Adventure” as if it were a short story.

[6] For an analysis of computer programming culture during this time period, see Kidder, 1981; Levy, 1984; and Hafner and Lyon, 1996.

[7] *The New Hacker's Dictionary* [Raymond 1996] repurposes the entry <http://www.catb.org/~esr/jargon/html/V/vadding.html> from “The Jargon File”, an older compilation of computer culture, at one point edited by Don Woods.

[8] The Usenet groups `rec.games.int-fiction` (for players) and `rec.arts.int-fiction` (for authors and theorists) remain important community forces, along with the annual Interactive Fiction Competition (for short games) and the XYZZY Awards. IF authors who regularly post relevant critical, theoretical, review, or how-to essays include Stephen Granade (<http://brasslantern.org>) and Emily Short (<http://emshort.wordpress.com>). Since 1994, the e-zine “SPAG” has published reviews and interviews (currently at <http://sparkynet.com/spag/>). A wealth of other community resources are available at <http://ifwiki.org>, including a FAQ resource for those who are new to the genre.

[9] See “Archives and Meta-resources” [Jerz 2002].

[10] The published evidence on “Adventure” is not always reliable. In a rare interview, Crowther warned that his “grasp of times and history and such is pretty fuzzy” [O'Neill 1990, 3].

[11] The depth of Montfort's inquiry into interactive fiction is suggested by “Interactive Fiction as ‘Story’, ‘Game’, ‘Storygame’, ‘Novel’, ‘World’, ‘Literature’, ‘Puzzle’, ‘Problem’, ‘Riddle’, and ‘Machine’ ” (in *First Person: New Media as Story, Performance, and Game*, MIT, 2004) and “Face It, Tiger, You Just Hit the Jackpot: Reading and Playing Cadre's *Varicella* ”, (co-authored with Stuart Moulthrop, in *Fineart Forum* 17:8, Aug 2003).

[12] Dalenberg gives the tag CROW0000 to this original version, in a genealogy of early “Adventure” files [Dalenberg 2004], and a “Family Tree” [Dalenberg 2006] with links to various downloadable versions.

[13] In response to my request, Les Earnest (SAIL executive officer, 1965-1980), Bruce Baumgart (former Stanford Ph.D. student, now an employee of the Internet Archive) and Martin Frost (systems manager of Stanford's CS department) kindly gave Don Woods web-based access to a tape backup of his Stanford student account. Woods chose five files from that backup tape, which he identified as components of Crowther's original FORTRAN 4 source code, and made them available for scholarly study (see Crowther and Woods, “Adventure”). The two oldest files (a pair representing the data and the code) are dated March 11, 1977. According to Woods, these files represent Crowther's original work. The archive includes three more files from late March, showing some of the first changes Woods made in both the data and the code. For an analysis, see part 2 of this article, *Exploring Colossal Cave in Code*.

[14] Juul (2005) admirably attempts to heal the rift between the rules-based and narrative-based approaches to games scholarship.

[15] Consider “Freefall” [Plotkin 1995], a remediation of “Tetris”. This text game, created as a joke, begins with the following words: “You wake up. You have no memory of who you are, or where you are, or what you have been doing. A peculiarly vibrating, tinny music pours from an invisible source. Then you see the tremendous chunk of stone falling towards you.... ”

[16] MUD-related scholarship is far too detailed to catalog here, but see Turkle (1995).

[17] According to Crowther's help text, “MOST OF MY VOCABULARY DESCRIBES PLACES AND IS USED TO MOVE YOU THERE.” (Excerpt from Item 51 in Table 6.)

[18] A bumper sticker and T-shirt slogan often seen in cave country reads “Cavers rescue spelunkers”.

[19] An audio file of the command "PLUGH":

[20] "Before long, team leader Dave West hesitated at a junction. 'You'll notice I'm not following you anymore', he said, prompting Jerz to backtrack and choose another route. After a few more similar false starts, Jerz finally realized that the proper direction from that junction was *straight up...*" [Jerz and Thomas 2005]

[21] It is possible to get to the other side of the fissure without conjuring up the crystal bridge, but the presence of the bridge, like the uttering of the magic words, permits the player to navigate more efficiently.

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