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Tempest

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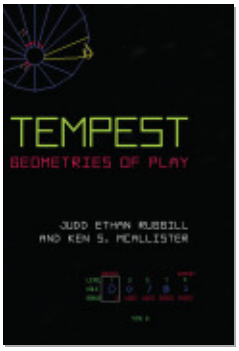

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Notes

Introduction

1. For more on these console competitors, see Wolf et al. (2003) and Herman (2001). For a detailed look at the Atari VCS in particular, see Montfort and Bogost (2009).

2. It is important to note here that we are not suggesting that *Tempest* is free of intertextual connection. On the contrary, the game (and indeed every game, system, peripheral, and paratext) is very much a part of the industrial, cultural, and ideological ecosystem Ken McAllister terms the "computer game complex" (McAllister, 2004). Rather, what we mean here is that *Tempest* is less overtly referential and referenced than many other games.

3. NPCs (non-player characters) are those game characters with which a player interacts but cannot directly control. The advancing aliens in *Space Invaders* (coin-operated machine and Atari VCS/2600), the zombies in *Left 4 Dead*'s (2008) campaign mode, the turrets in *Portal 2 (2011)*—all are NPCs.

4. For a detailed discussion of this principle in the context of the archival and organizing mission of the Learning Games Initiative Research Archive, see our "Computer Game Archiving and the Serious Work of Silliness" (2011).

Chapter 1

1. Jed Margolin, an Atari engineer at the time of *Tempest*'s development, rejects the attribution of the game's mathbox microcode to him, even though he is listed in the credits of ported versions of *Tempest* for the PlayStation and Sega Saturn. According to a series of e-mail communications we had with him, as well as a number of documents Margolin has assembled on his website (http://www.jmargolin.com) that relate to the vector graphics projects and hardware on which he worked while at Atari, it was Mike Albaugh and Dan Pliskin who designed the *BattleZone/Tempest* mathbox:

> I was not on the *Tempest* team. And I don't think I did any work on the game. I know that I did not do the Mathbox microcode, either on *Tempest* or on *BattleZone*. Mike Albaugh did the Mathbox microcode for *BattleZone*. (Dan Pliskin designed the Mathbox hardware.) The *Tempest* Mathbox would have been the *BattleZone* Mathbox. If there were any changes to the microcode I think Mike would have done it. (Margolin, "Re: Tempest and Thanks," 2012)

The mathbox microcode for *Tempest* referred to here was essentially the graphics engine that generated the vectors within the game.

2. The most definitive data on *Tempest* production units comes from German arcade collector Andreas Kraemer, whose archive includes not only many early vector games but also innumerable manuals, promotional flyers, sales catalogs, trade magazines, and other related source texts concerning the vector graphics game industry. See http://www.andysarcade.de. The International Arcade Museum uses the same numbers, citing US collector Scott Evans's access to old Atari paperwork. Evans runs CoinOpSpace.com, a classic arcade, pinball, and console collecting online community. See http://forums.arcade-museum.com/showthread.php?t=56305.

3. These statistics were drawn, according to the report, from polls conducted among arcade operators by *Replay Magazine* and *Play Meter Magazine*, the primary trade journals for the coin-op entertainment industry (both then and now).

4. See http://www.arcade-museum.com/members/statistics/most-collected-videogames.php.

5. In programming terminology, "to document code" means to embed non-executing lines of text that explain what particular lines or chunks of executable code do. The purpose of such an effort is to make the operation of the code completely transparent, able to be understood at a glance even by people new to it. McCormick's project, then, aims to explain every single line of Theurer's *Tempest* code, a massive undertaking but one that makes it much easier for others to modify the game efficiently and with only a modicum of subsequent debugging.

6. This said, both *Tempest Tubes* and *Tempest Multigame* were hacks originally designed to run on the actual *Tempest* coin-operated system.

7. Minter designed *Tempest 2000* and *Tempest 3000*, while Zorzin is a programmer at Minter's company, Llamasoft. See chapter 4 for a detailed discussion of *Tempest*'s hacks, clones, remakes, and sequels.

8. Appropriately (given the nature of this legend), Polybius is the Greek god of history who also developed a number of early cryptographic techniques.

9. For more on *Polybius*, see its Wikipedia, coinop.org, and KLOV pages, as well as the *Polybius* homepage (http://www.joltcountry.com/polybius.html).

10. As the *Atari* Tempest *Operation, Maintenance and Service Manual* notes, "the words *INSERT COINS* and *GAME OVER* alternate if there are no game credits. The words *PRESS START* and *GAME OVER* alternate if there are game credits" (1981c, 14).

11. Depending on if the coin door was made in the United States or United Kingdom, *Tempest* could also be adapted to accept US fifty cent and one dollar coins; German one, two, and five Deutsche mark coins; Belgian five franc coins; Swiss one franc coins; French one and two franc coins; Swedish one kroner coins;

Hong Kong one dollar coins; Canadian twenty-five cent coins; UK ten, twenty, and fifty pence coins; Italian one hundred lire coins; Japanese one hundred yen coins; Australian twenty cent coins; and Spanish twenty-five peseta coins (Atari, *Atari* Tempest *Operation*, *Maintenance and Service Manual*, 1981c, 47, 51).

12. The *Atari* Tempest *Operation*, *Maintenance and Service Manual* uses "level" and "tube" interchangeably, while the machine itself uses "HOLE" on the skill select screen. As noted earlier, Dave Theurer, the game's designer and programmer, records that the idea for *Tempest* came from a nightmare "where monsters are coming out of a *hole* in the ground and I've got to kill them before they get to the surface and kill me" (Theurer, 1995, our emphasis). In a subsequent video interview done as a background piece for the Sony PlayStation collection *Midway Presents Arcade's Greatest Hits: The Atari Collection 1* [*sic*], Theurer retells this same origin story and emphasizes the idea that the geometric play space of *Tempest* began as a hole: "I've got this nightmare about this hole in the ground and there's these monsters from the center of the earth that are trying to get out of the hole and you have to try [to] smash them before they get out of the hole and kill you" (1996).

13. For an accessible discussion of vector graphics, see the "Imaging Technologies" section of Wolf's "The Video Game as Medium" (2001c, 19–23). For a more detailed treatment, see Jed Margolin's twinned 2001 articles "The Secret Life of Vector Generators" and "The Secret Life of XY Monitors."

14. The Z-axis is virtual because the display can only actually render lines defined by x-y coordinates and their vertices.

15. The specific color changes are as follows: "The shooter causes the two rails on which it sits to change color. Superzap causes the playfield to flash as enemies are zapped. Playfield rails flash rainbow colors when a player earns a bonus life. Pulsar enemies cause sections of the nearest rim to disappear, and during the pulse phase, adjacent rails to flash" (Atari, 1981c, 15).

16. If red Flippers exist at the top of the tube next to the player, these enemies need not be killed in order to progress to the next level. Spikes, too, need not be completely eliminated.

17. The second superzap also has a shorter and less complex illumination animation than the first, as well as a shorter concomitant sound notation.

18. This is noted by the text "Superzapper Recharge" that appears at the bottom center of the screen during the transition through the star field.

19. Spikers also change the topography of the playfield, though these changes are generally only felt at the end of a level when the shooter travels down the tube and the player must avoid or destroy the remnants the Spikers have left behind.

20. As noted earlier, *Tempest* was released in three cabinet styles: upright, cabaret (a smaller, more compact version of the upright), and cocktail (at which two players face each other across a single screen mounted parallel to the ground and the screen image flips 180° at each player's turn, ensuring that the action is always displayed appropriately for the active player). For more on the various game cabinets, as well as technical schematics (including a memory map), see Atari 1981a; 1981b; 1981c; 1981d; 1981e; 1981f; 1981g.

21. Notably, Skill-Step was not *Tempest*'s only revenue enhancing feature. The game also sported a Bonus Play Feature, which allowed the machine owner to set up

the game so that bonus plays could be awarded for selectable coin combinations (e.g., a free play with the insertion of four quarters at once). As the upright cabinet's *Operation, Maintenance and Service Manual* notes, "This bonus feature encourages players to insert more money than just the minimum 25¢ required for one game" (Atari 1981c, 10). *Tempest* was also configurable for multiple play prices, a variety of currencies, and a series of coin counting settings to accommodate these options (e.g., coin doors that accepted differential and sequential deposits). For more on game pricing options and coin door settings, see Atari 1981c, Atari 1981e, and Atari 1981f. For a deeper discussion of the economics of arcades, see Carly A. Kocurek's informative "Coin-Drop Capitalism: Economic Lessons from the Video Game Arcade" (2012).

22. Playing through the first nine tubes one by one nets the player 34,000 points. If, however, the player chooses to skip the first eight tubes, begins at the ninth, and completes it, the result is 59,000 points.

23. According to Tim Nicholls, a specialist in arcade cabinet art, the artist for *Tempest*'s cabinet art is unknown. In personal correspondence with us, Nicholl's noted that

> Atari cabinet art is often almost impossible to attribute to an artist. . . .The company was so focused on game design, programming, and manufacturing that the artwork was often just offloaded onto jobbing freelance graphic artists whose names didn't matter to anyone except the accounts department who wrote the cheques! I've spoken to a number of people who were working for Atari in the late 70s and early 80s and they all pretty much said the same. The other thing that makes it hard to track down the artists is that Atari forbade them from signing their work, unlike companies like Williams and Bally-Midway, who outsourced their artwork to Advertising Posters in Chicago and allowed the artists to add their signatures to marquees, etc. I believe later Atari arcade titles had their cabinet art created in-house, but I'm not sure at what point the change happened. One clue might be that I can see very similar construction in the artwork of *Warlords* and *Tempest*.

24. Among the changes arcade managers were able to make to machines with flagging returns were relocating them to end isles and door-facing clusters, changing the flanking machines, turning up the volume, and tweaking the play settings (e.g., lowering the difficulty settings or the number of points necessary for an extra life).

25. These figures are conservative in that, as noted earlier, records indicate that about 29,000 *Tempest* machines were produced, but the sales and coin-drop income figures cited here are based only on the 20,000 machines that were sold prerelease—most likely for use in the various venues where such machines regularly appeared. It is possible, therefore, that *Tempest*'s first-year revenues (sales and coin-drop) were more than 30 percent higher than the estimate we provide here.

26. In the ten-year period surrounding the release of *Tempest*, Hollywood studios released a spate of films capitalizing on the visual drama of 3-D wireframe graphics. Among these films are *Soylent Green* (Metro-Goldwyn-Mayer 1973), *Westworld* (Metro-Goldwyn-Mayer 1973), *Futureworld* (American International Pictures 1976), *Close Encounters of the Third Kind* (Columbia Pictures 1977), *Star Wars* (Twentieth Century Fox 1977), *The Black Hole* (Walt Disney Productions 1979), *Alien* (Twentieth Century Fox 1979), *Star Trek: The Motion Picture* (Paramount Pictures 1979), *Looker*

(Warner Bros. 1981), *Blade Runner* (Warner Bros. 1982), *Tron* (Walt Disney Productions 1982), *Return of the Jedi* (Lucasfilm 1983), and *The Last Starfighter* (Universal Pictures 1984). Notably, *Soylent Green* includes a brief scene in which the arcade game *Spacewar!* is played, *The Last Starfighter* has a protagonist who graduates from video game hero to galactic hero, and all of the above films—with the exceptions of *Futureworld* and *The Black Hole* (which was made into a 1981 Gottlieb pinball machine)—had spin-off arcade and console games. From this perspective, *Tempest*'s landmark status in part rests on the fact that it was quintessentially characteristic—not astonishingly unprecedented—of what the general public imagined when it thought about the future. For a more detailed treatment of the cultural context that gave rise to and was subsequently impacted by *Tempest*, see chapters 3 and 4.

27. We use the term "diegetic" in much the same way as Alexander Galloway, though with perhaps less emphasis on narrativity. The diegesis is the space that contains the playfield and within which game play occurs. Non-diegetic space, by contrast, is that which contains information or metadata about the diegesis (e.g., the high score list).

28. In both *Asteroids* and *Pac-Man*, the player is able to move the avatar from one side of the screen to the other by exiting the frame.

29. Arguably, the transition from one level to the next offers a tactical play advantage in that it gives players a brief respite from the intense concentration that the game demands. Such "wave relief," as the time between successive onslaughts might be termed, could certainly be considered diegetic but would represent an aspect of the diegesis quite different from the rest of the play experience. Specifically, wave relief—common in virtually all video games, whether due to technical limitations (loading screens) or narrative necessity (cut-scenes)—springs from that part of the diegesis that demands rest and release rather than action and focus.

30. This is not to say, however, that off-screen space in film and television is only used in this way (or in games, for that matter). On the contrary, off-screen space serves a variety of functions, including as a technique by which to transcend real space and time in time-based media. We are grateful to the anonymous reviewer of this manuscript who drew our attention to this point, and we look forward to seeing more comparative studies on the subject. In the meantime, for a helpful delimitation of the various kinds of video game space, see Wolf's "Space in the Video Game" (2001b).

31. For a recent and detailed exploration of the concept of immersion, including its limitations as a critical apparatus and a possible alternative in the form of "incorporation," see Calleja (2011).

Chapter 2

1. Influential on both Wolf and us was "A Taxonomy of Computer Games," the third chapter in Chris Crawford's archetypal treatise *The Art of Computer Game Design* (2011). Though both formative and smart, Crawford's treatment was intentionally broad, offering only two categories—"Skill-and-Action Games" and "Strategy Games"—each of which had six subcategories. For scholars and archivists bent on more nuanced classifications, these twelve categories are inadequate. Notably, *Tempest* figures prominently in Crawford's book where it is showcased for its innovative design and its intimidating look and feel.

2. By contrast, the on-screen information exterior to the playfield and which describe and quantify play—the high score, the player's current score, and the number of shooters remaining, for example—are expressly representational.

3. We use "break" here advisedly, taking our cue from James Newman's excellent analysis of game structure. While *Tempest*'s star field is very much part of the game, and the diegesis is wholly intact and operational while the field is displayed, there is no possibility for direct player interaction with it. There is no change to effect, and the player can only wait for active play to resume after the star field has been replaced by a new tube. This is not to say, however, that there is no chance for engagement; on the contrary, the player can still be very much engaged with the diegesis and immersed in the game world. Rather, there is simply no way to modify the play environment within the constraints of the game when the star field is on display (one could always unplug, hack, or damage the machine, of course). It is a moment in which the player can see but not touch, as it were.

4. As we explained in chapter 1, bonus points are available for selecting a higher start level, though the importance of these points as a component of the total score decreases as the player advances in the game.

5. Interestingly, the Shoot 'Em Up—and many other genres—subsequently expanded on this idea, and today it is not uncommon for games of all types to track and display to the player different metrics of engagement and commitment (e.g., total amount of time played, achievements earned and remaining, unlockable playable and aesthetic content, and so forth). Clearly, part of the appeal of video game play—or at least an index to how pleasure is manufactured in and by video games and players—flows from the awareness and recognition of one's in-game performance.

6. The notable exception here is the cocktail cabinet, which, because of its form factor, has a less detailed marquee and art scheme than the standard and cabaret machines. The cocktail marquee features the head of just one creature, though this creature too—with its sharp, curvilinear lines and toothy rictus—is designed to appear malicious.

7. To be fair, the game market in the early 1980s was considerably larger and more robust than it was in the 1970s, which perhaps accounts for some of *Tempest*'s ability to popularize three-dimensional gameplay. Likewise, game technologies had advanced, allowing for more sophisticated artistry and gameplay possibilities. The growth of the game market and technological advances notwithstanding, there was something commercially compelling about *Tempest* in particular: its total unit sales were almost double that of *Battlezone*, a top-selling, vector-based three-dimensional game released the year before (Atarigames.com). *Nota bene*: This is assuming that data on atarinumbers90s.pdf is correct. Those numbers seem to be confirmed in part by the Fujihara memo (Fujihara, 1983), which details *Tempest*'s unit sales (but not *Battlezone*'s).

8. It is not uncommon for players to participate in game development too (e.g., through an open beta), as well as for player-generated elements to become part of a commercial game world after a game's release (e.g., player-crafted items in *Team Fortress 2*).

9. We explore this idea in detail in "Invention, Authorship, and Massively Collaborative Media" (2013), arguing that there is no such thing as a single-authored

video game (or, in fact, a single-player video game). Rather, we contend, the medium is inherently collaborative in its development and play.

Chapter 3

1. We would also like to note that we are especially mindful of the rhetorical complexity of context as an organizing concept. Jennifer Fredale deWinter characterizes this problematic succinctly: "As a rhetorical trope, context tends to fix complex practices in single places, which allows for the celebration of the authentic or original. Further, it privileges production while masking complex practices of circulation and consumption while simultaneously constraining seemingly infinite possibilities into finite frames that then become static and naturalized" (2008, 7).

2. We make this claim despite Theurer's own insistence—in one interview—that he made *Tempest* "to let people have a good time and to just get away from the frustrations of normal life [. . .] and get into another state of mind and forget about all your problems and just blow things up" (1996, 2'24"). In our view, originary intentions and subsequent conscious and unconscious influences on that project are more unavoidable than mutually exclusive. Tellingly, this position would seem to be supported by Theurer himself, who in the same video interview describes his own recurring nightmare—monsters climbing out of a hole to get him—that ultimately gave rise to *Tempest*'s central aesthetic.

3. The phrase "reasonably informed American" indexes a fact we discuss later in the chapter, namely, that the rise of global media—from international newspapers and news magazines to satellite broadcasting and twenty-four-hour-a-day cable television—made it commonplace for most people in industrialized countries to have at least some global awareness of major events of the day.

4. In a 1981 address to the Association of Computing Machinery, legendary computer scientist Tony Hoare implored:

> And so, the best of my advice to the originators and designers of ADA has been ignored. In this last resort, I appeal to you, representatives of the programming profession in the United States, and citizens concerned with the welfare and safety of your country and of mankind: Do not allow this language in its present state to be used in applications where reliability is critical, i.e., nuclear power stations, cruise missiles, early warning systems, anti-ballistic missile defense systems. The next rocket to go astray as a result of a programming language error may not be an exploratory space rocket on a harmless trip to Venus: It may be a nuclear warhead exploding over one of our own cities. An unreliable programming language generating unreliable programs constitutes a far greater risk to our environment and to our society than unsafe cars, toxic pesticides, or accidents at nuclear power stations. Be vigilant to reduce that risk, not to increase it. (1981, 12)

5. Abraham Maslow describes "self-actualization" as "the desire for self-fulfillment, namely the tendency for him [a person] to become actualized in what he is potentially. This tendency might be phrased as the desire to become more and more what one is, to become everything that one is capable of becoming" (1943, 382).

6. *Battle Beyond the Stars* is also notable for its opening sequence, which bears a remarkable resemblance to the transitional sequence between tubes in *Tempest*.

7. That the planets were in alignment is quite literally true. On March 10, 1982, all the planets of the solar system were in syzygy, that is, all aligned on the same side of the sun. Coincidentally, Nolan Bushnell and Ted Dabney had chosen the name "Syzygy Engineering" for their business dealings before they formally incorporated as "Atari, Inc." in June of 1972.

8. See http://arcade.hofle.com for Hofle's project.

9. One way to interpret this seeming conflict of interest (e.g., Sega's arcade division competing with its home console division) is that in a transitional period of consumer electronics, the largest manufacturers were hedging their bets. The proof of this may be seen in the curious hybrid game known as "video pinball." Beginning in the mid-1970s, companies such as Chicago Coin Manufacturing Company and Atari began developing video game versions of pinball, some housed in traditional pinball table formats (e.g., *Super Flipper* [1975]), but most in more conventional-looking upright video game cabinets (e.g., *Video Pinball* [1978]). While this trend was short-lived in the arcade, essentially providing a segue from the waning pinball tables to the waxing video game machine, it gained a foothold in the PC and home game console market where it thrives even today (e.g., FarSight Studio's *The Pinball Arcade* [2012] is available on most mobile devices and newer game consoles). For a good introduction to this trend, see Rossignoli 2002, 303–10.

10. For a visually overwhelming tour of the history of electromechanical and solid state pinball machines, see Marco Rossignoli's 2002 *The Complete Pinball Book: Collecting the Game and Its History*.

11. Tellingly, the pinball industry ultimately fared much better than the arcade video game industry. An *Economist* article from 2000 reports that pinball machine sales climbed steadily throughout the 1980s, eventually peaking in 1992 with 100,000 units sold that year ("The Last Pinball Machine" 2000). Video game arcades, on the other hand, declined precipitously in the late 1980s, and those that did stay afloat mainly featured variations on the beat-'em-up genre, including such machines as *Mortal Kombat* (1992), *Double Dragon* (1987), and *Street Fighter* (1987). *Star Trek: The Next Generation* (1987) actor and popular über-geek Wil Wheaton beautifully documents this decline in a 2007 post on the *Suicide Girls* website.

12. Indeed, several sources suggest that it was just this sort of executive-level timidity about innovation combined with a conservative approach to workplace practices (e.g., punching time clocks and dressing professionally) that led many of Atari's early employees to resign soon after the company was sold to Warner Communications (Atarimuseum.com n.d.; Herman 2001, 39–41).

13. The impending demise of the arcade was common knowledge by late 1983. The September 1983 issue of *Star Tech Journal: The Technical Monthly for the Amusements Industry*, for example, featured a story headlined "Home Computers to Win Electronic Game Market." The story concludes with these encouraging numbers for the home market but grimmer predictions for arcades: "Based on a retailer survey [by Front & Sullivan], the report predicts an average annual current dollar growth rate of 55 to 75% for home-computer hardware over the next two years and 60 to 85% for home computer software. Programmable video-game console sales will rise 20 to 30% a year and the cartridges to be played on them will rise

35 to 50%. A much sharper curtailment may be taking place in the coin-operated electronic video game market. Unit sales are expected to fall 32% in 1983. Operator revenues will drop steadily from $7.0 billion in 1982 to $4.6 billion in 1987" ("Home Computers" 1983, 3).

14. *Starcade* episodes 3 (*Tempest* is introduced at 2:57) and 13. Notably, episode 95 had *Major Havoc* as the grand prize. *Major Havoc* was a conversion of the *Tempest* machine. For more on *Starcade*, see http://www.starcade.tv/starcade/tv/starcadetv-shows.asp.

15. In fact, *Tempest* actually appears in a number of films, including *Night of the Comet* (1984), *Fast Times at Ridgemont High* (1982), *Twilight Zone: The Movie* (1983), *Joysticks* (1983), *Running Scared* (1986), *Maximum Overdrive* (1986), and *Death Wish 4: The Crackdown* (1987). As we noted in chapter 1, the game was also featured in Rush's 1982 music video for "Subdivisions."

Chapter 4

1. The Magnavox Odyssey, for example—the very first commercial, cartridge-accepting console—supported a pump-action shotgun-shaped light gun.

2. In the annals of *Tempest*, the EMM Software/Euro-Byte version is notable for having its own sphere of influence. In what could reasonably be called a port-sequel, Rob Fearon's 2012 PC-based *G:Force* is to Euro-Byte's *G-Force* (programmed by Boris Baginski) what Llamasoft's *Tempest 2000* (programmed by Jeff Minter) is to Dave Theurer's *Tempest*. As this chapter shows, *Tempest*'s distinctiveness often meant that its alter egos were variants in only the most exiguous ways. Yet it was often these very details, insignificant as they seem to the uninitiated, that made (and makes) any variant fun or unplayable to gamers. Clearly, Baginski struck just such a deep note for Fearon, who heard and responded to it many years later.

3. Interestingly, the documentation for the ZX Spectrum, Amstrad, and Atari ST versions of *Tempest* refer to the game's tubes as "Hyperspatial Wireways," a term never used in any of the coin-operated machine's promotional or technical documentation. It is unclear what this lexical alteration was intended to accomplish, though it arguably more accurately describes the central play space of *Tempest* than does the more official or conventional "tubes," "holes," or "levels." See Hughes (1987).

4. Technically, the Windows/Mac versions of these games were not ports. Ported software generally leaves most of the original code intact, with programmers making only those modifications necessary to ensure that the program displays and runs correctly on the new platform. For *Microsoft Arcade*, Microsoft actually rewrote *Tempest*'s game code so it not only ran more efficiently on PCs and Macs but provided gamers with additional settings to enhance game play. Nevertheless, these versions were very similar to the arcade originals and thus probably are better referred to as "remakes" rather than ports, hacks, clones, or sequels.

5. The PC and Sega versions are titled *Atari Anniversary Edition*, the PlayStation version is known as *Atari Anniversary Edition Redux*, and the Game Boy Advance version is known as *Atari Anniversary Advance*. While the game list of each collection varies slightly, *Tempest* is on all *Atari Anniversary* editions, a fact that again signifies the game's enduring marketplace (if not ludic) appeal.

6. Code Mystics was started by Jeff Vavasour, who also founded Backbone Entertainment, which ran the Digital Eclipse retro gaming studio. Even a cursory glance at the *Tempest* section of the gameography at the back of this book will reveal how key Digital Eclipse has been to keeping the memory of 1980s-era arcade games alive.

7. For a detailed look at the company's early history, see Cohen (1984); Vendel and Goldberg (2012).

8. See http://www.atariprotos.com/2600/software/tempest/tempest.htm and http://www.atariprotos.com/5200/software/tempest/tempest.htm. Notably, the commercial packaging for the 5200 version—again, not yet (nor ever) released—appeared on a store shelf in a scene from the 1984 movie *Cloak & Dagger* along with the also never released Atari 5200 titles *Battlezone* and *Cloak & Dagger* (Reichert, review of Atari 5200 *Tempest* prototype).

9. Retro game programmers design and build new games for antiquated game systems, including most cartridge-based consoles from the 1970s, 1980s, and 1990s. See Brundage (2007) for a brief treatment of Vectrex retro programming. Another, more popular approach to playing old games is through the use of emulation software. Emulators are applications that mimic particular hardware configurations. *Project Tempest Jaguar Emulator*, for example, is an Atari Jaguar emulator developed by Ville Linde in 2004 that allows users to play Jaguar games (including *Tempest 2000*) on their *Windows* machines simply by downloading a Jaguar game's original code from one of several online archives and opening it in the emulator.

10. *Abyss* is technically commercially available: Dondzila released it as a novelty on his 1999 *Vecmania* cartridge, which contains several other fully working titles.

11. For more details on Brown's *Tempest Tubes* and other arcade machine hacks, see http://www.thundercross.freeserve.co.uk/temped/tubes.htm and the *Topcast Pinball Talk* podcast with him at http://www.pinrepair.com/topcast/topcast_58.mp3 (starting at around 1:54:00).

12. Mills's *TempEd* website notes that it is "the world's first and indeed only *Tempest* Level Editor." Technically, this is true. As we describe later in this chapter, however, Thorsten Kuphaldt's *Typhoon 2001*, a robust *Tempest 2000* clone, also included a level editor, as does Mark Incitti's 2005 clone, *T3mp3st* for *Windows*. The existence of not one but three editors for *Tempest*—all of which were developed as freeware by dedicated fans long after the game's quiet arcade passing—suggests that *Tempest*'s enduring charms work particularly well on gamers who are also captivated by the guts and mechanics of games. In this respect, *Tempest*'s look and feel may well represent a techno-aesthetic which, while it has long since passed out of favor among less computer literate consumers more attracted by Hollywood's and Madison Avenue's ever-changing futurist visions, remains elegant and timeless among gamers who themselves daily trade in bytes, vectors, and geometric math.

13. For details on Cowgill's *Tempest Multigame* kit, see the kit's excellent installation documentation—*Tempest Multigame Installation and User's Manual* (1999) and "Tempest Multigame Addendum" (2003). The date of *Tempest Multigame*'s release—2000—corresponds with a related project that Cowgill contributed to known as the "*Tempest* Code Project." Initiated by Josh McCormick on September 25, 1999, the *Tempest* Code Project was "to comment [i.e., "explain"] the *Tempest* code [line by line] to such a degree that the workings of the software and hardware are easily un-

derstood." McCormick's (and Cowgill's, and third contributor Ken Lui's) intention was to make Theurer's complex *Tempest* code more accessible so that "it would be possible to create meaningful modifications to *Tempest*, or to create new games for the *Tempest* hardware" (McCormick 2004). As of late 2014, the project has lain incomplete and dormant since September of 2004, with roughly 10 percent of more than 11,000 lines of code actually annotated (Ibid.).

14. *Bedlam* was not the only *Tempest* clone released in 1982, but it is the best-documented one. Another was *Storm* for the Tandy/Radio Shack TRS-80 Color Computer, which was made but poorly distributed by Computerware. Today, *Storm* is quite difficult to come by, no doubt because its poor quality retarded sales. *Bedlam* was better promoted, and *Tempest* was still a dominant presence in arcades at the time. For a detailed review of *Bedlam*, see Brundage (n.d.).

15. Such constantly spinning on-screen objects reputedly caused players of both Theurer's prototype and the later Vectrex version to become nauseous—generally not an appreciated game mechanic.

16. Though it is unclear whether there is a connection to *Arashi* or *Tempest*, 1978 also saw the release of a popular and award-winning Japanese children's manga series called *Game Center Arashi*, which was published until 1984. In 1982, *Game Center Arashi* (written by Mitsuru Sugaya) was spun off into an anime series that ran for twenty-six episodes. Both the manga and anime feature a protagonist named Arashi Ishino, a highly competitive video gamer who routinely defeats arcade challengers with a variety of special techniques, many of which rely on a special top that Arashi spins and uses to speed up his response times. Though we are by no means manga or anime scholars, a cursory investigation suggests that *Game Center Arashi* may be among the earliest fictional protagonists constructed around an identity shaped by video games, and perhaps especially by *Tempest*.

17. *Tempest 2000* became the best-selling 64-bit game for the Jaguar, with some reviewers calling it "the only reason to buy a Jaguar" (Monkman 2007).

18. For a deeper history of Minter's development process, browse his website (llamasoft.com). It has numerous tales about the gaming industry's early history, as well as about his inspirations for *Tempest 2000* and *Tempest 3000*.

19. According to Minter, the "backstory" to which Kuphaldt is referring here is not a single event but rather a series of negative experiences with developers and publishers who used Minter's work—including his work on *Tempest 2000* and *Tempest 3000*—without crediting him textually or monetarily. The height of such disregard occurred around the development of *Tempest X3* for the Sony PlayStation:

> The situation with "Tempest X" on the Playstation [sic] was somewhat different and rather more unsettling, really. I'd always wondered why they'd fiddled about with the game design of Tempest 2000 when I thought it was just fine as it was. Years later I actually spoke online to one of the coders on the game and he told me they'd been specifically instructed to alter the design of Tempest 2000 by enough so that they would "reduce the royalty burden" of the game. Which basically means changing my game just enough to be able to cut me out of any royalties. Which I not unnaturally thought (and still do) was a pretty shitty thing to do. (Minter 2012)

Minter also notes in the same communique that it would be difficult for him to develop new *Tempest*-related properties now because "I suspect that whoever holds the rights to the name 'Atari' these days would shut me right down" (Ibid.).

20. According to *EDGE Magazine*, Minter was asked to endorse the game but refused ("AINC it Funny" 2012).

21. Minter is unapologetic about the number of times he has returned to *Tempest* as both source and vessel for ideas, noting in one interview that *Tempest* is "the game that influenced my life the most" (Yamoto 2008).

22. "Homage" is not only accurate in, shall we say, spiritual terms, but also in the eyes of the law: *Space Giraffe* is legally not a clone, hack, or sequel. Llamasoft and Infogrames could not come to terms on a licensing agreement when the game was under development, so *Space Giraffe*'s genetic connection to *Tempest* is only discernible once the game boots up and knowledgeable players recognize the similarities for themselves (Zorzin 2007).

23. The *Space Giraffe* section of the Llamasoft website abounds with phrases meant to distinguish *Tempest* from *Space Giraffe*. See, for example, "The Basics" and "Walkthrough."

Chapter 5

1. It is just this circumscription (and its consequences) that make *Tempest* so different from Jeff Minter's *Tempest 2000*, which actually rewards players who allow enemies to invade the near rim for the purposes of trapping and destroying them there en masse.

2. It is hard not to think here of Michel de Certeau's walker in the city. As de Certeau (1984) explains, it is one's ambulation through a city—one's choices to start, stop, linger, detour, and so forth—that give both style and meaning to that city's geographies. The same seems true with *Tempest*'s tubes, and indeed with many game topographies; it is the players' choices that animate and configure the spaces.

3. Importantly, holographic storage is inescapably material as well; consider the machinery needed to make and access the data. We thank one of the reviewers of this manuscript for reminding us of this materiality.