

TEMPEST

GEOMETRIES OF PLAY

JUDD ETHAN RUGGILL
AND KEN S. MCALLISTER

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Tempest

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by Judd Ethan Ruggill and Ken S. McAllister

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JUDD ETHAN RUGGILL
AND
KEN S. MCALLISTER

UNIVERSITY OF MICHIGAN PRESS
ANN ARBOR

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JER: To my buddy, Sky—rest in peaches . . . or at least in melon. And to my buddy, Simon, the Sneaky Pete: I do so miss the kangaroo foot.

KSM: For Yrgl, B.O.C.: The world's greatest tripod.

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Introduction

The year 1980 was a landmark one for video games. As Scott Cohen notes in his now classic history of Atari, the company's "[r]evenues for 1980 doubled to about \$415 million, and operating income quintupled to \$77 million, one-third of [parent company and media giant] Warner's total 1980 operating income. In six months Warner stock shot up 35 percent. Atari was the fastest growing company in the history of America" (1984, 73). While Atari was certainly the largest industry player at the time and expanding at an unparalleled rate, it did not hold a monopoly on the video game medium. In fact, comparatively, the game industry in 1980 was remarkably open to new entrants and innovations. Activision, for example, "sold \$65.9 million in software [that same year], for a profit of \$12.9 million" (Cohen 1984, 83), and there were many extant and emerging competitors to Atari's Video Computer System (VCS), including the Odyssey² (Magnavox), Intellivision (Mattel), and Channel F (Fairchild).¹ At the same time, coin-operated, console, and handheld play were all lively and synergistic. Not only were the arcade and home markets both bustling, but console developers were also actively and successfully drawing from arcade source material (e.g., Atari's VCS adaptation of Taito/Midway's *Space Invaders*). In addition, 1980 was a particularly fertile time for game design. Developers released a superabundance of titles that rank among the most iconic and influential of all time: *Battlezone*, *Berzerk*, *Crazy Climber*, *Defender*, *Missile Command*, *Pac-Man*, *Zork: The Great Underground Empire*, and others. Indeed, while video game history is full of important moments, 1980 may well be the year the medium came of age as a commercial, artistic, and cultural force.

That *Tempest* should have emerged in the wake of this especial élan

is only fitting. It is a landmark game in every sense of the term, from its abstract and futuristic imagery and gameplay to its impact on more than three decades of subsequent game design and development. It is a game that today, more than thirty years after its release, even non-players recognize as somehow unique and important.

And yet, *Tempest* largely remains as enigmatic an artifact as when it was first released. Little has been done to unpack its significance or trace its form and functioning. Part of the reticence to undertake this work can be traced to the state of the field: like its object of focus, video game studies is still nascent and mercurial. It has not yet been wholly annealed by time or tradition, and as a result, much path-breaking is still to be done. By the same token, *Tempest* is also a special case. It does not have a slew of successors that build out its iconography and thus constantly point back to the archetype (cf., *Donkey Kong's* [1981] Jumpman refashioned as Mario in *Mario Bros.* [1983] and numerous subsequent titles in the Nintendo catalog), nor does it extend a design concept or narrative that is specifically connected to a larger cultural phenomenon that can serve as a focalizer (cf., *Call of Duty: World at War* [2008] and its redeployment of real-world events, geographies, and ideologies). *Tempest* does not attempt verisimilitude (cf., *Zoo Tycoon* [2001]), specific analogy (cf., *BurgerTime* [1982]), or emanate from a product tie-in (cf., *Advanced Dungeons & Dragons* [1982]). The game is surprisingly idiosyncratic in its deployments and evocations, but it has also been concealed from scholars' view by the noise and clutter of game studies' exciting but uneven development.²

In this book, we enumerate and analyze *Tempest's* landmark qualities, exploring the game's aesthetics, development context, and connections to and impact on video game history and culture. Specifically, we:

- Describe the game in detail, unpacking its latent and manifest audio-visual iconography and the ideological meanings this iconography evokes;
- Consider the game generically, that is, in terms of the general styles and logics it initiated, reinscribed, and expanded upon;
- Delve into its design and production history to reveal the creative and industrial processes that shaped the game's development, release, and reception;
- Analyze it as part of a franchise as well as a singular artifact.

Our purpose, ultimately, is to explicate the game and its broader cultural significance.

To facilitate this goal, we have organized *Tempest: Geometries of Play* telescopically, moving from textual analysis to contextual analysis over the course of five chapters. We begin with a close reading and conclude with a cultural one, enhancing the specific observations of each chapter with the broader ones that follow. As in *Tempest* itself, knowing what is coming is key to getting the most out of the experience. We offer, therefore, the following chapter summaries as a kind of strategy guide to the book and its multiple perspectives on one of video game history's foundational titles.

Chapter 1: Reading *Tempest*

Among *Tempest*'s notable qualities is its striking visual design, which is simultaneously abstract, futuristic, and classical. Understandably, part of this design can be traced to the technological limitations of the day: the game's austere, geometric look is as much a function of the machine's Wells-Gardner Color X-Y Monitor and vector graphics as it is an exemplar of *Tempest* creator Dave Theurer's artistic vision and design sensibility. That said, Theurer is clearly exploring the expressive potential of the video game medium differently in *Tempest* than in *Missile Command* (1980), his immediately preceding title (also a landmark game). Whereas *Missile Command* is representational and concerned with off-screen space—the targeting reticle, cities, and surface-to-air missiles look the part (more or less), and the attacking bombs fall from a source beyond the edges of the screen—*Tempest* is more abstract and probes the surface and depth of the screen itself. Its shapes are alien and mathematical, and its design and nonplayer character (NPC) movement emphasize both the possibility of escape (the ubiquitous vanishing point of the “tubes” or levels) and the simultaneous inescapability of the screen (the action is strictly confined to the playfield except for the brief transition between tubes, during which the player's avatar is rocketed down the field toward the vanishing point).³ The iconography is not so much realistic as expressionistic, a pushing at and playing with the sense-making possibilities of the video game medium and the visual and aural traditions it borrows from theater, film, and television.

In chapter 1, we introduce *Tempest* and offer detailed descriptions of its iconography and play logics, examining the ways in which they reify and experiment with player experience and expectation. For instance, *Tempest* famously toyed with the by-then well-established linearity of arcade gameplay by allowing players to choose their own starting level and skip levels deemed already mastered. With this dynamic in mind—that is, the experience of *Tempest* as arcade game and as something new in the arcade

itself—we closely examine *Tempest* and its play as a way to understand what in fact Theurer created. The game’s geometric playfields certainly presaged the three-dimensionality popular today to be sure, but *Tempest* also advanced rail and first-person shooter design (something we take up in chapter 2). In addition, *Tempest* helped concretize for video game designers and publishers the possibility that abstraction could be commercially successful, and thus helped expand the parameters of video games as a creative culture industry. From this perspective, games released decades after *Tempest*, including such notable titles as *Killer7* (2005), *Rez* (2002), and *Katamari Damacy* (2004), are traceable descendants of Atari’s 1981 classic; we consider this avenue more fully in chapter 4. Ultimately, chapter 1 focuses on unpacking the formal qualities that enabled a perceptual shift away from the fetishization of representative game aesthetics to a style that was not only more abstract but also—to go by the game’s tenure as a staple in any self-respecting arcade in the early 1980s—more fun than its conventional cousins. In the process, we offer a deep description and subsequent interpretation of *Tempest*’s imagery, sounds, play space, and design ideologies.

Chapter 2: A Genealogy of *Tempest*

Complementing *Tempest*’s striking visual design is the way this design and the play it enables draw on, foreshadow, and blur a range of games. For example, many titles prior to *Tempest* occupied semiotic domains that could not have been more clear, despite the era’s primitive graphics: *Space Wars* (1977) included two space ships—one the wedge-shaped and rocket-propelled form that later became the iconic vehicle of *Asteroids* (1979), and the other a dead ringer for the U.S.S. Enterprise of television series *Star Trek* fame—an artillery shell, and a star; *Lunar Lander* (1979) sported mountain and cave scenes as well as an easily identifiable representation of the Apollo Lunar Module that had captured the world’s attention with its edge-of-the-seat missions from 1969 through 1972; and *Armor Attack* (1980) depicted a war zone populated by jeeps, tanks, and helicopters. Slotting a quarter into any of these games initiated a play experience that resided well within a clearly defined cultural script: shoot the enemy and/or survive the landscape. *Tempest*, on the other hand, offered no such visual cues to clarify for players the genre at hand, despite the fact that it, too, depended on shooter and survival scripts. Consequently, *Tempest* does not nest well within traditional generic categories. Yes, players have to shoot enemies and survive a variety of deadly environmental threats, but the

perspective—the framing of the player’s actions within the game’s diegesis—is ambiguous: is the player controlling a ship’s weaponized outrigger (making the game a first-person shooter), or is the player controlling the weapon itself (making the game a third-person shooter)? As if to amplify this ambiguity, the *Tempest* machine’s front control panel simply calls the avatar the “shooter.”

Range of motion also configures style designations, and again, *Tempest* resists easy categorization: the shooter is fixed to the near edge of a three-dimensional geometric form—called a “tube” in the manufacturer’s documentation—within which each battle is waged; by modern conventions, this design suggests a rail shooter. At the end of each battle, however, that previously confined weapon is suddenly released from its rail and barrels toward the vanishing point, even while remaining in the player’s control and still susceptible to the tube’s extant natural dangers (e.g., spikes). Chapter 2 explores these and other stylistic paradoxes, as well as the game’s then-unusual elements (e.g., Skill-Step play system, the hyperludic weapon, three-dimensional gameplay, a distinctive physical interface), arguing that *Tempest* ultimately produced a hybrid genre all its own, one that informs game design right up to the present. In so doing, we argue, the game also set the stage for an explosion of play-style variation that has become a minor but defining characteristic of the contemporary game industry.

Chapter 3: Contexts

Like all creative work, video games are both products of and responses to their environments. While a given game may diverge from or perhaps even critique its context, it also distills it, crystallizing the material, cultural, and ideological events that play host and backdrop to the processes of game design, production, and play. To understand a game, therefore, one must understand its context, or rather, its contexts, as there are many and they are often intertwined (e.g., global, national, industrial, play, and so forth). Nowhere is this more important than in the study of landmark games, for it is these games’ aesthetic, technological, and interactive contributions and the contexts they reflect that reverberate most prominently through the history and meanings of the video game medium and its cultures.

As far as *Tempest*’s contexts are concerned, they were defined by innovation and turbulence. For example, in the late 1970s and early 1980s, new developments in personal and industrial computing (e.g., the IBM PC) along

with never-before-seen pictures of the solar system snapped by exploratory spacecraft (e.g., *Voyager 1*) sparked excitement in the national imagination and promised to turn science fiction into science fact, the present into the future. At the same time, the deepening freeze of the Cold War (e.g., the US boycott of the Moscow Olympics), an intensification and proliferation of armed conflict around the world (e.g., the Sino-Vietnamese War, the Ugandan Civil War), and a spate of natural and human-made disasters (e.g., the eruption of Mount St. Helens, the Three Mile Island nuclear reactor meltdown) intimated that such a future-made-present might not be quite so rosy. This paradox of hope and fear was magnified by scores of films, television programs, and video games (e.g., *The Road Warrior* [1981], *Battlestar Galactica* [1978–1979], *Missile Command*), which alternately hailed and assailed the possibilities and problematics of computer-mediated, nuclear, and galactic life. It was an ideal (and even ineluctable) incubator for a vector-generated, space-themed shooter based on a designer's dream of invading aliens and made on the heels of a game about a nuclear attack.

Chapter 3 documents these and other social, cultural, and industrial developments that formed the contexts within which *Tempest* was developed, released, and played, and that contributed to the game's iconicity. It also explores the game in terms of designer Dave Theurer's oeuvre, focusing on the overarching interactive as well as aesthetic sensibilities *Tempest* shares with Theurer's other Atari titles.

Chapter 4: Life after *Tempest*

Despite its commercial success and iconicity in game and popular culture, *Tempest* has had a relatively modest post-release life, spawning only a handful of remakes since 1981. Certainly some of this paucity is attributable to the original game's minimalist design; there is not a lot of visual, narrative, or ludic material for developers to build upon easily. But the same might be said for *Tetris*, which by contrast has produced dozens of iterations, sequels, and spin-offs. There is also the issue of *Tempest's* distinctive physical interface—a heavy machined steel and aluminum bearing/flywheel spinner knob assembly packed with a specially formulated damping grease (“Nyogel 779”)—which does not translate particularly well to the standardized and now somewhat prosaic control layouts of home game consoles, handheld devices, and personal computers. Indeed, the game is as much about the haptic and kinaesthetic possibilities of the controller and its seemingly endless spin as it is about spartan and abstract imagery. At the same time,

the game industry has long produced all manner of specialized ancillary controllers for home use (e.g., the Nintendo Power Glove) and even marketed games with their own unique devices (e.g., *Steel Battalion's* [2002] controller, which has nearly fifty buttons and switches, two joysticks, and three foot pedals). That a *Tempest* iteration has not been prominent among them is surprising given the game's iconic status.

Chapter 4 considers *Tempest* post-release, analyzing the game's subsequent—and curiously few—iterations. We tease out why the game seems very much tied to an historical moment as opposed to transcending that moment the way *Super Mario Bros.* (1985), *Metal Gear* (1987), and other commercially successful games have done so in the form of additional branded titles. We also examine the specific ways in which *Tempest's* later variations adhere to and diverge from the original's conceptual blueprint, concentrating on the addition of levels, power-ups, multi-player modes, and graphic updates. Ultimately, we contend that the game's relatively anemic post-release life is not so much due to a lack of a “there” there—that is, a genuine shortage of adaptable, recyclable material—or a difficult-to-translate way of interacting with this material, but rather to a strange surplus of meaning and possibility, one that—in tandem with several corporate misfortunes at Atari—has militated against attempts at reuse and redeployment.

Chapter 5: Conclusion

Chapter 5 serves as both a summative and explicative conclusion to the book, recalling as well as expanding the analyses of the preceding chapters as a way to delimit *Tempest's* overall cultural significance. For example, we revisit the game's unusual inclusion of the user-selected start difficulty (a variant of which is today de rigeur in games of all types), arguing that the feature embodies in detail the dialogical nature of video gaming. Being able to directly alter a game's formal and ludic qualities emphasizes the fact that players inevitably shape the gamic artifact just as their play is shaped by it, and that this dialogue is not necessarily a function of a given technological innovation but rather has long been possible with (and is perhaps even intrinsic to) the video game medium. Importantly, this dialogism is distinct from (though certainly ineluctably connected to) the “readerly” qualities found in any medium. It is, instead, an effect of human-computer interaction, and in particular, the type of human-computer interaction associated with video games: the ability of machines to become active and

largely reciprocal human playmates. Foregrounding this phenomenon so explicitly and so early in the commercial history of the video game is truly one of *Tempest's* landmark features, a feature that even today influences how games are designed, played, and studied.

In addition to explicating this and other interactive qualities in terms of their cultural import, we also recall *Tempest's* visual design as an aesthetic and cultural watershed. The game's admixture of abstractionism, futurism, and classicism, for instance, probed the boundaries of the industrial/commercial artistry of the time, suggesting to developer and player alike a sense of commodity beyond common fetishism. With *Tempest*, the game medium was revealed as art in the most canonical sense, that is, not just as an expression of a given sensibility but a worker of magic and miracles, of dialectic and transformation. It is this very quality that today is helping drive the development and proliferation of serious, learning, and avant-garde games.

Finally, we contextualize *Tempest* in terms of its materiality. The game not only figured prominently in the oft-called "golden era" of video games (1977–1984) but also helped brand Atari as a company that produced exceptional and innovative games (a reputation that continues today despite the company's countless missteps and near-death experiences over the years). As a result, *Tempest* is an important guide to understanding the industrial and cultural history of the video game, a history shaped as much by Atari as by any other company.

Together, these five chapters are meant as a conceptual and practical road map of how *Tempest* means, from its technical specifications to its industrial permutations to its cultural significations. Readers will note that in the course of the book, we deploy a fairly stable lexicon to describe these many aspects of *Tempest*. This lexical work was by no means intuitive. Throughout the project, our sources—frequently such things as manufacturers' technical manuals, trade industry promotional materials, and authoritative but fairly obscure historical treatments—seemed specifically designed to thwart any such homogenization, routinely calling the same avatar, legal concept, or mechanical part by a multitude of different names. Undaunted (mostly), we have to the greatest extent possible selected, defined, refined, and otherwise clarified the key terms herein so that through a modicum of streamlining and simplification this book is able to facilitate greater understanding of the subject at hand. At the same time, it is worth pointing out that there are various lexica associated with *Tempest's* aesthetics

and technologies, lexica that have developed among numerous interested stakeholders—from arcade owners and retro gamers to service technicians and professional geometers. In general, we defer to the authority of the game’s various operation and service manuals in our analyses. These manuals were produced by Atari as specific reference and instructional guides for machine owners. The manuals bear the company’s imprimatur (as well as the game’s official warranty and copyright information) and contain detailed and exact figures, schematics, and nomenclature of game hardware and software. They are, in our opinion, the definitive source for descriptors for a book such as this. For a list of the manuals, guides, schematics, memory maps, and so on that we consulted, see the “Atari” listing in the Works Cited. Where the official corporate documentation proved insufficient for a particular line of analysis—for example, in our discussion of the actual geometric shapes that comprise *Tempest’s* playfield, player avatar, and NPCs—we reference and rationalize these sources appropriately.

One final note: as co-directors of the Learning Games Initiative and its extensive and circulating collection of video games and related materials and paraphernalia, we took this project on with the mindset of archivists committed to the principle of “preservation through use.”⁴ This approach to archival work prioritizes hands-on experience with artifacts rather than vigilant physical protection and a look-but-don’t-touch public interface. This is because the primary mechanism by which video games mean is through use, not only in the play itself that they command but also through the particular kind of play each game enables, constrains, arrests, perpetuates, celebrates, and capitalizes on. It is rare, however, that game scholars have the opportunity to catalog the range and contexts of these experiences—this despite the fact that historically such exercises must surely be among the most important undertakings scholars can do. This book, then, is an attempt to document for posterity how *Tempest* means now and meant in the past. In this sense, *Geometries of Play* extends the principle of “preservation through use” by recording the multiplicities involved in that use, in effect amplifying and propagating the preservative power of use and of the rich but fragile memories such use generates. This is also one of the central motives behind the Landmark Video Game series itself: document the outcomes of preservation through use practices.

As archivists, we mean for this book to cast new and enduring light on an ancient (by the standards of consumer electronics at least) milestone in the history of computer-based games and in the history of play itself. As

game scholars, we mean for *Geometries of Play* to provide others interested in *Tempest* or in its multitude of contiguous cultural contexts an amalgam of starting places and reference points to enrich their work and to extend the field of game studies in both specific and general ways. Finally, as gamers who spent hours and small fortunes peering down at the vivid electrical grids and menacing galvanic opponents of *Tempest*, we mean to honor one of the game industry's landmark creations.

CHAPTER I

Reading *Tempest*

One of our principal goals in this book is to “read” *Tempest*, that is, to describe and analyze the game’s audiovisual iconography and the meanings this iconography evokes. When literary scholars perform this kind of work, they generally follow a set of interpretive conventions designed to reveal both the structure and nuance of the material at hand. So-called close readings involve treating a given literary text strictly within the confines of that work’s language, syntax, and grammar. According to this framework, the author’s intentions, the historical context of the literary work, the political implications of the piece in later ages, and other such interpretive interventions are disallowed; in close reading, the meaning of the piece qua literature is all that matters. In contrast, the reading method known as “new historicism” is founded on the principle that literary works cannot be understood without understanding their broader contexts. Thus, a new historicist reading would not only carefully examine the exact language of a short story but might also try to situate that story within the zeitgeist of the time in which it was composed, recognizing analogies that connect the story to contemporary current events, for example, or identifying thematic patterns linking the story under analysis and other stories written in the same time and place.

While new historicism, close reading (often called “new criticism”), and the numerous other interpretive methods used to analyze conventional literary works have much to offer, their advantages often break down when these methods are applied to “texts” they were never designed to explicate. This is not to say that such conventional analytical techniques ought not to be applied to meaning-making materials other than novels and poems—

say, to *manbwa*, web advertisements, or industrial films—but rather that doing so necessarily limits what can be revealed about such exoteric texts.

The challenge of reading these newer texts is perhaps nowhere so deeply felt as when traditional analytical frameworks are applied to “emerging media,” that is, expressive forms such as interactive fiction, digital poetry, and alternate reality games. Unsurprisingly, due to their inherent multi-medial and multi-experiential qualities, video games are among the most complex “texts” that scholars analyze today. In addition to such literary commonplaces as plot, dialogue, setting, characterization, and so on, video games often invoke a flood of interconnected media forms, styles, and genres, from still photography, chiaroscuro, lens flares, and stop-motion animation, to genre forms such as westerns, noir, and horror, to play styles that include platforming, racing, shooting, and puzzle-solving. Realistically, given this diversity of integrated interpretive stock, there is no definitive method for analyzing video games. What the field of game studies is gradually realizing, in fact, is that video games, like many other forms of old and new entertainment media, need to be explicated in a variety of ways and with the operative presumption that such analyses are cumulative and complementary—even when they contradict one another.

This has certainly been our operative presumption as we have written this book. We need to say a few words about our epistemology and methodology, therefore, before embarking on a close reading of *Tempest*'s aesthetics, technologies, play spaces, literary features, and design ideologies. Our approach in this chapter is rooted in the textual analysis practices of literary-influenced media and cultural studies. In keeping with these practices, we hold the formal qualities of the game as both nucleus and touchstone in our study, building out from the palpable to the ideological, and from the textual to the intertextual. However, we also complement our textual analysis with a contextual one, drawing from the fields of history, political economy, and rhetoric to articulate and extrapolate the iconographies and implications of the formal analysis. Our goal is to provide a focused interdisciplinary examination, a study rich in diversity and nuance but also one with an obvious and tangible through-line. And to be sure, we want always for the landmark qualities of *Tempest* to be in the foreground.

With this approach acknowledged, we now offer some basic background on the game. We then provide a thick description and explication of *Tempest*'s audiovisual, technological, and ludic design, and conclude with an analysis of this design itself.

Background

Tempest—called *Aliens (Vector)* and *Vortex* in pre-production—was developed by Atari Incorporated in 1980–1981 and released in October of 1981. Dave Theurer (pronounced “TOY-er”) designed and programmed the game (including all of the in-game art and audio), Morgan Hoff was the project leader, Sam Lee was the hardware engineer, Doug Snyder was the development technician, Mike Albaugh handled the mathbox microcode, and Dan Pliskin designed the mathbox hardware.¹ It was programmed in 6502 assembly language with structured macros, and according to Theurer, was iteratively debugged on paper printouts, given to typists to make the corrections on a DEC PDP-11/20 system, recompiled and linked for running on a custom-built arcade machine hardware emulator, then debugged again using a paper printout of the code (Theurer 1995; Margolin 2001a).

Originally, the game was meant to be a first-person version of *Space Invaders* (1978), but when the prototype failed to become popular among Atari staff—purportedly the standard first round of market testing at the company at that time—Theurer moved on to an idea based on a nightmare he had several times: monsters are crawling out of a hole in the ground to kill him. In the initial design of the game, the player moved the playfield (in effect, a tubular “hole”) around a canon of sorts, but this proved to be too resource intensive for extant hardware and too nausea inducing for players. Theurer then opted to make the playfield static and the canon mobile. This new design became enormously popular with the Atari staff, and the game was soon green-lighted for full production.

In its heyday, *Tempest* was among the most popular and profitable arcade games in the world (see below for details about its global reach); collectors’ websites report that approximately twenty-nine thousand *Tempest* units were produced, twenty thousand of which were sold to distributors pre-release. Of these, 25,112 were in the upright form factor, 1,663 were cocktail (table-top/two-player) cabinets, and 2,176 were cabaret (smaller and more compact upright) machines.²

Both cocktail and cabaret versions of the machine were released a few months after the upright version, in December of 1981. According to an internal marketing research document for Atari’s Coin Operated Games Division, *Tempest* was listed twelve times among the top five earning games for the period between October 1981 and September 1982, trailing only *Donkey Kong* (1981), *Pac-Man* (1980), *Ms. Pac-Man* (1981), and *Turbo* (1981),



Fig. 1. Different arcade machine form factors

and outstripping other arcade classics such as *Defender* (1980), *Centipede* (1981), *Robotron 2084* (1982), *Galaga* (1981), *Frogger* (1981), and *Tron* (1982) (Martinez, 1983).³ Such popularity meant significant money for Atari and certainly contributed to the company's meteoric rise at the time. Given that Atari promotional materials for the machine indicate that the upright cabinet retailed for \$2,295, the cocktail cabinet for \$2,095, and the cabaret version for \$2,195, the gross revenue generated by *Tempest* machine sales alone (i.e., not including play revenue) after its 1981 release were in the neighborhood of \$66 million (Kraemer 2005).

To our knowledge, no data exists about the game's resale revenues, but given its continued popularity, these monies may well match or even exceed the release revenues. As of late 2012, the *Killer List of Video Games* (KLOV)—an online database maintained by the International Arcade Museum and the Vintage Arcade Preservation Society—lists *Tempest* as the second most-collected arcade machine, exceeded only by *Ms. Pac-Man*.⁴ Part of this collectability and continuing popularity is due to the game's source code having been made publicly available in the late 1990s. As a result, in 1999, Josh McCormick started the "Tempest Code Project," an initiative to document every single line of the game's source code.⁵ While still not complete as of this writing, McCormick's effort has resulted in numerous hacks, most of which are now played on desktop computers running arcade machine emulation software rather than on the original hardware itself. Duncan Brown's 1982 *Tempest Tubes* and Clay Cowgill's 1999 *Tempest Multigame* are notable examples of such hacks, the latter of which included the two prototype versions of the game developed by Theurer, as well as *Tempest Tubes*, all three authorized revisions of the original *Tempest* code, and an original vector-based *Breakout*-like game.⁶ In addition, the game has been ported to a number of home consoles and computers (e.g., Atari ST and Jaguar, Sega Saturn, PlayStation, Xbox 360), redone as a free Java game on the web, and had at least two sequels made—*Tempest 2000* (1994) and *Tempest 3000* (2000)—none of which approached the popularity or critical acclaim attained by the original. Finally, there are also a number of homages to the game, the most popular of which is likely Jeff Minter and Ivan Zorzin's Xbox 360 title *Space Giraffe*.⁷

Tempest has also figured prominently in popular culture, having appeared in music videos ("Subdivisions" by Rush in 1982), movies (*Night of the Comet*, 1984), television shows (*American Dad*, 2007; *The Simpsons*, 2006), and received some media attention in the rock music scene for being musician Dave Grohl's (Nirvana, Foo Fighters) favorite arcade game

(“Dave Grohl and Atari *Tempest*,” n.d.). In one of the more bizarre cultural turns of the game, *Tempest* became the basis for a well-circulated urban legend in which Theurer’s original game design—the tube rotates instead of the cannon—had been turned into a game called *Polybius*.⁸ Depending on the version of the story, which began circulating sometime in the early 2000s, *Polybius* was part of a government experiment conducted in one or more arcades in the suburbs of Portland, Oregon. Developed by a company called “Sinnesloschen,” German for “sense deletion,” *Polybius* had the power to erase memories, give nightmares, cause nausea, turn itself on, and make players permanently averse to playing arcade games. It supposedly existed in arcades for only a few months, and at random times its coin boxes would be emptied by men in black suits who also collected mysterious data from the machine itself. There are now a number of websites devoted to tracking the *Polybius* urban legend, and several people have worked on actually developing the game and its cabinet art based on the various stories about it. The fact that *Tempest* is almost always deployed as part of the retelling of this popular legend is yet another example of *Tempest*’s captivating and long-lived suggestive powers.⁹

Clearly, *Tempest*’s cultural reach has been and remains considerable. Like most iconic artifacts that come to signify (or are made to signify) a particular moment in history, *Tempest* left a permanent mark on popular cultures the world over despite having a relatively brief moment in the spotlight. By 1983, Atari had already designed and released a *Tempest*-cabinet conversion that allowed machine owners to recycle all but a few of the game’s parts, add a few new ones, and change the cabinet art to become a brand new game: *Major Havoc* (1983), designed by Atari designer/programmer Owen Rubin (*Skydiver* [1978], *Battlezone* [1980], *Tunnel Hunt* [1982]). But while *Tempest*’s superstar status faded in the ceaseless blitz of novelty that characterizes the consumer electronics industry, it had been burnished onto the minds—and hands—of countless arcade goers as one of the medium’s greats. In the next sections we detail the game’s play, aesthetics, and innovations, if not to capture a bit of the game’s magic, then at least to sufficiently describe the ingredients and processes so important to *Tempest*’s alchemy.

Getting Started

After being powered on and running through a brief diagnostic routine, the *Tempest* machine enters “attract mode,” that is, the mode the machine idles in while not being played and after its diagnostic self-test has been

completed. In this state, the game cycles through three images on its display: a twelve-second high score/copyright screen, an Atari *Tempest* logo display with play credit and price information, and a gameplay action sequence along with the words “PRESS START” or “INSERT COINS.”¹⁰

When the coin drop is activated—by quarters in the United States, but the machine could also be outfitted with coin mechanisms for other currencies—and the player spins the control-panel knob, the machine exits attract mode and enters “Ready-to-Play Mode.”¹¹ In this mode, the player has ten seconds to rotate the control-panel knob to select a starting skill level from “NOVICE” to “EXPERT”; these skill levels correspond to tubes/holes/levels in the game: the higher the level number, the more difficult the gameplay.¹² In addition to the text-based skill indicators, the screen also displays the shape of the corresponding tube and bonus value for completing it (we discuss the importance of this feature below). Once the player has inserted sufficient coinage, selected a skill level, and pressed the fire button (or run out of time), “Play Mode” begins.

Play Mode Aesthetics

Tempest is a vector-based, three-dimensional shooting game in which the action takes place on and is confined to a series of geometrical tubes.¹³ In simple terms, this means that the play screen is comprised of a series of lines defined by x-y-z coordinates and across which the player navigates and fires. In its most basic form, *Tempest*'s vector/playfield looks like a sheet of ruled paper held parallel to the ground with the lines running toward a vanishing point.¹⁴ At all times during play, the following interface elements



Fig. 2. Play screen

are at the top of the screen: at the far left, the number of “shooters” (the player’s avatar) remaining, represented as miniature yellow versions of the full size shooter (i.e., two small shooters means two play chances left); at left-center, the player’s score in a large green sans serif/digital typeface; at center, in smaller green type, the current high score and the initials of the player who logged it; and below the high score in blue is the current player’s level.

Each of *Tempest’s* tubes is rendered in one-point linear perspective and consists of sixteen line segments or “rails” that emerge near the vanishing point and run along the z-axis toward the player, effecting a sense of depth and three-dimensionality. Both the near and far ends of the rails are capped and connected by line segments, which serve to delimit the shape of the tubes and give the appearance of “looking into a well” (Atari 1981c, 15). There are sixteen different tube shapes, and the set is repeated in different colors and increasing difficulty levels over the course of the game’s ninety-nine levels (levels 1–16 are rendered in blue; 17–32 in red; 33–48 in yellow; 49–64 in cyan; 65–80 are invisible [i.e., rendered in black on a black background]; and 81–99 are green). Regardless of tube color, individual rails and indeed the entirety of the tube itself can temporarily change color due to in-game events, such as the repositioning of the shooter, the deployment of a specific weapon (e.g., the Superzapper), the earning of an additional shooter, or the activity of the game’s enemies (e.g., Pulsars).¹⁵ The transition from one tube to the next (i.e., a level change) occurs when the player has destroyed all of a level’s enemies.¹⁶ In this transition, the shooter is rocketed down the tube into the vanishing point, which is replaced by a star field through which play is transitioned to the near end of the next tube.

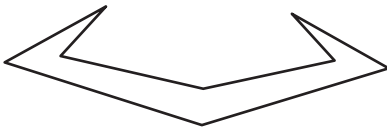


Fig. 3. Shooter

The shooter is a yellow, simple, non-convex, eight-sided polygon or “claw-like” avatar that straddles adjacent rails and which the player controls via a plastic dial (officially, “the control-panel knob,” and commonly,

“the spinner”) connected to the game’s encoder-wheel (Atari 1981c, 15). The control-panel knob (and thus the shooter) is capable of rapid, bidirectional rotation, though the shooter’s movement is confined to the near rim of the tube, as if on a rail. In closed tubes (such as the first, a circle), the shooter can move endlessly in either direction around the rim, both

reifying and belying the concrete limitations of the playfield. In open tubes (such as tube nine, a V-shape), by contrast, the endless spin and its associated freedoms are curtailed by the finite ends of the playfield, which influence both navigational possibilities and play strategies. The shooter can produce up to eight shots at a time on-screen, each of which is capable of destroying a single enemy—except for the game’s “spikes,” which we discuss in detail below. The shooter’s shots disappear upon enemy contact or when they reach the far rim of the tube.

In addition to the shooter, the player is also able to deploy the Superzapper, an invisible weapon that illuminates the tubes’ rails when activated and whose initial use destroys all on-screen threats simultaneously except for spikes and enemy shots. Superzapper use, however, is limited to twice per tube, and the second deployment only destroys a single random enemy from among the various on-screen threats.¹⁷ The Superzapper is fully recharged in the transition between tubes.¹⁸

Tempest contains five types of enemies that the player must confront over the course of the game: Flippers, Tankers, Spikers, Fuseballs, and Pulsars. All of the enemies emerge from the vanishing point of the tube, destroy the shooter on contact, and, with the exception of Fuseballs, are capable of firing destructive bursts toward the near rim down the gutter they occupy. These bursts disappear if they touch the player’s shooter, a shooter’s shot, or the rim of the tube. Again, all enemies can be destroyed by the shooter or by a superzap, save the spikes—intra-gutter lines of various lengths—the Spikers leave behind. Spikes can only be destroyed piecemeal by the shooter’s shots. Finally, like the tubes, the color of the enemies changes over the course of the game. Enemy shape, movement, and ability are as follows:

Flippers

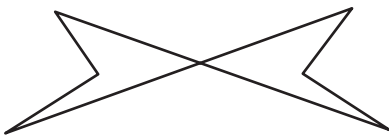


Fig. 4. Flipper

Flippers are crossed quadrilaterals with chevron-shaped ends. They travel toward the near rim of the tube linearly up the gutter they emerge onto. If they are not destroyed while in the gutter and are able reach the

near rim, they traverse along it by flipping 180 degrees from gutter to gutter until they are destroyed or they destroy the shooter.

Tankers

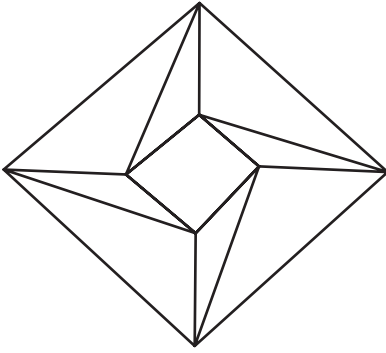


Fig. 5. Tanker

Tankers are rhombs with an embedded star polygon. They, too, travel toward the near rim of the tube linearly up the gutter they emerge onto. If they are not destroyed while in the gutter and are able to reach the rim, they disassociate into two other enemies (e.g., Flippers).

Spikers

Spikers are rotating segmented spirals that travel toward the near rim of the tube linearly up the gutter they emerge onto, and then recede toward the vanishing point. As they move toward the near rim, Spikers deposit a spike—a line segment capped by a spiral—that originates at the far rim of the tube and terminates proximal to the near rim (or wherever the Spiker is destroyed by the player). If a Spiker is not destroyed and is able to fully recede to the far rim of the tube, it will reemerge in a new gutter or as a different enemy (e.g., a Tanker).



Fig. 6. Spiker

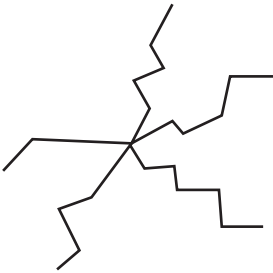
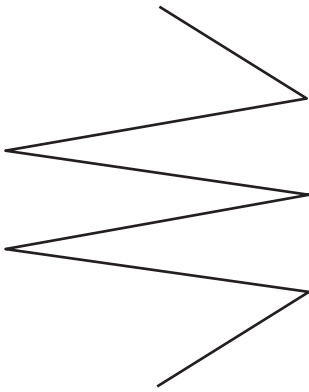


Fig. 7. Fuseball

Fuseballs

Fuseballs are starfish-shaped enemies with five jagged line segments as arms. They are able to quickly slide toward the near or far rims of the tube along the rails of the gutters, as well as move from rail to rail, crossing the gutters at any point on the playfield.

Pulsars



Pulsars are rail-width linked line segments that pulse rhythmically, changing back and forth between straight and jagged polylines as they move about the playfield. Like Fuseballs, they are able to move toward the near or far rim of the tube, and like Flippers they move between gutters by flipping 180 degrees. At the height of their pulse, Pulsars essentially electrify the gutter they occupy, illuminating its rails and temporarily making the gutter deadly for the shooter.

Fig. 8. Pulsar

While Flippers, Tankers, Spikers, Fuseballs, and Pulsars are the orthodox enemies of *Tempest*, the game's playfields also serve an enemy function. Not only do the various tubes shape player movement via their layout—and as a result often force shooter destruction by creating insurmountable scenarios—but also the gutters of a given tube can become charged by Pulsars and destroy the shooter upon contact. In addition, charged gutters temporarily alter the layout of the playfield itself (as, in fact, do Flippers and Fuseballs when they reach the rim of the tube and make the gutter they occupy temporarily impassible and the gutters behind it unreachable), disrupting its linearity, geometry, and the flow with which the player is able to navigate the field's topography.¹⁹ As we noted above, *Tempest* contains a series of “invisible” levels (65–80) in which the tubes are rendered in black against a black background and thus are not visible to the player (though they are still navigable according to the underlying geometry of the given tube). Like the different shapes and limitations of the tubes, and the ways in which the playfield's layout can be altered by the presence and actions of the game's primary enemies, the invisible levels work to challenge player ability and undercut expectation. They also serve as a reminder of the game's overt caprice: the topography of the playfield is mutable, but player movement and possibility are not. It is the player's specific ability to adapt, rather than the game's opening up of new affordances, that is key to progressing through *Tempest*.

Finally, *Tempest*'s spare but striking visuals are complemented by an evocative soundscape, much of which is designed to offer aural clues to the on-screen action. The shooter's movement from gutter to gutter, for example, is accompanied by an audible click; the faster the shooter moves across the rim, the faster the clicks are heard, giving the player an indica-

tion of velocity without having to visually confirm it. This is particularly useful in later stages of the game when the play difficulty increases and visual attention must be primarily devoted to tracking enemy emergence, movement, and threat level. Similarly, enemy shots are accompanied by a brief tapping sound, a non-visual reminder to the player that there is an additional threat on the playfield. There are, of course, aural notations accompanying the destruction of enemies and their shots, the achievement of point bonuses and a new high score, the shooter's transition from the near end of the tube to the far end (and from the vanishing point to the star field and next tube), and so forth, all of which help both to intensify and mitigate the game's visual flurry.

Having described *Tempest's* playfield, avatar, enemies, movement and color patterns, level advancement rules, and aural components, we move now to a description of the game's technological and interactive contribution to video game design and its industrial history.

Innovation

Tempest premiered a number of new features for the Atari coin-operated line, with the upright version of the cabinet incorporating the Wells-Gardner Color X-Y Display vector-generator monitor (x and y here refer to the horizontal and vertical axes, respectively), Skill-Step gameplay, an easy-to-service cabinet with casters, a 72-tooth encoder-wheel-based control system lubricated with a special gel, and a resonating chamber for the speaker (Atari 1981c, 3).²⁰ This impressive list of innovations is supplemented by the management- and service-friendly construction of the shell within which these new technologies reside:

The newly designed cabinet has casters at the back of the game, allowing you to easily move the game within your establishment. The attraction panel, with its new construction, uses a polycarbonate decal laminated to tempered glass. Luggage-style latches allow easy opening of the control panel. A wood panel separates the coin box from the components in the back of the game, eliminating the need for a power-interrupt interlock switch on the coin door. Finally, the game and auxiliary PCBs [printed-circuit boards] are mounted back-to-back on the cabinet wall and are separated by plastic stand-offs. (Atari 1981c, 3)

Clearly, the *Tempest* upright cabinet was constructed with the busy arcade overseer in mind, as well as with an eye toward the rigors of the arcade itself and the near constant need for machine repair.

Not surprisingly, the cocktail version of the cabinet was also quite innovative, with a Wells-Gardner Color X-Y Display, responsive encoder wheel, vertical coin door (for improved service access and security), adjustable cabinet height (including a standing level for non-seated play), and a cabinet design that centralized much of the game's internal workings into a single and easily accessible space. The cabaret version of the game also included new features, among them a tempered glass display shield and fluorescent tube-illuminated attraction panel (Atari 1981e, 3).

While the design and service elements of the cabinet were certainly important to arcade owners at the time, it was the color monitor and Skill-Step system that are particularly significant to the industrial, cultural, and design history of the video game medium. The Wells-Gardner Color X-Y Display was the first color x-y monitor in an Atari coin-operated cabinet; prior to *Tempest*, Atari's vector games shipped with black and white displays. As with cinema, the addition of color opened up new expressive possibilities for the video game medium—possibilities Theurer is clearly exploring via the game's static tube design (i.e., as a repeating set) but changing color palette over the course of its 99 levels. The Skill-Step system, for its part, promoted two additional incentives to play: 1) it offered a user-selectable start difficulty, and 2) it temporarily allowed the player to continue play



Fig. 9. Skill-Step
from *Tempest Tubes*

without having to return to the opening tubes and difficulty level. Initially, the player is given the choice to start at level 1, 3, 5, 7, 9, or 11. Should play advance beyond these levels during the course of a game, the player is given thirty seconds from the destruction of the last shooter to add additional money and continue play. Otherwise, the game will reset and the player's progress through the tubes will be lost.

Clearly, Skill-Step was a boon for arcade owners as it applied direct and immediate pressure for players to purchase additional play time. We say "arcade owners" here deliberately: while the game cabinets of the day could be found in all manner of places (e.g., bars, bowling alleys, convenience stores, restaurants, airports, bus stations, and so forth), they were the primary source of revenue for arcades, where direct inducement for sustained purchase was fundamental to the business model. Thus, even though machine owners of all types could benefit from the Skill-Step feature, it was especially important for arcade owners.²¹

But Skill-Step was also a way for the game to maintain its freshness: as the upright cabinet's *Operation, Maintenance and Service Manual* explains, "skillful players continue to be challenged while less experienced players try to master higher levels" (Atari 1981c, 14). This differential play mechanic—unusual at the time but ubiquitous now—meant that, for example, Player 1 could start at level 1 while Player 2 could start at level 5. Depending on each player's abilities, they could conceivably each play for roughly equal amounts of time—taking turns at the controls as with other multi-player enabled arcade games of the era—despite their different starting points. This mechanic of differential play difficulty is now at the heart of many video games, and is arguably one origin point for "adaptive A.I.," that is, control algorithms that alter, for instance, enemy NPC behaviors in order to maximize player engagement. By tracking a player's in-game performance, such control algorithms dynamically make enemies neither too easy nor too difficult for players to overcome.

Skill-Step also worked to help narrativize the game's play experience, tying movement through the tubes to tropes of progress, accomplishment, mastery, performance (in the sense of the arcade as a public and performative space), journeying, and rapid decision-making. The player is incentivized, for example, to begin the game at an advanced level: there are significant "BONUS" points awarded if one forgoes the opening tubes, thus establishing a built-in story valuing bold decision-making and challenging play.²² In helping narrativize *Tempest's* play experience in this and other ways—that is, in supplying the rudiments of a story to a game that did



Fig. 10. Assortment of technical documents

not readily seem to have one—Skill-Step provided a way to indirectly yet concretely supplement the game as a purely playful act, i.e., to give *Tempest* a tangible and interpretable significance beyond the refulgent but largely non-cognitive pleasures of simply doing. This type of narrativizing—perhaps sub-narrativizing might be a better term as Skill-Step is not so much a teller as it is an enabler of something to be told—helped to offset the technological limitations of the day and also to partly domesticate the abstraction of the game itself. Whereas many other games of that era attempted verisimilitude (e.g., *Extra Bases* [1980]), anthropomorphism (e.g., the naming and individual behaviors of *Pac-Man*'s ghosts), or offered titular or aesthetic indices to their content (e.g., Theurer's landmark game from 1980, *Missile Command*) as a way to both combat hardware and software limits and connect with players via the overt narrativization of play, *Tempest* did not dip into the cultural fund of easily recognizable mediated images, stories, and tropes. Atari was therefore under special obligation to domesticate the game somewhat, lest it seem too alien to be alluring to a mass audience.

There is one set of exceptions to this point. *Tempest's* promotional materials (e.g., “coming soon” flyers and posters), operation manuals, and cabinet art, all included images of fairly stock aliens: large glowing eyes, bulbous heads, sharp teeth, brutal claws, long tentacles, and so on. Given that the cabinet art was done after the game had been finished (see Theurer 1995), it was presumably designed to attract players who might not otherwise engage a machine that looked more like a geometry problem than an arcade game.²³ The fact that these same images were repeated on the covers of the technical manuals for the game’s various form factors is likely due to a corporate desire to maintain consistent brand identification across all components of the franchise.

The commercial need for narrativity in *Tempest* is further reinforced by the inclusion of a pause option in the game’s “Demonstration Mode,” which allows the machine operator to start at any of the first eighty-one levels, then “freeze game action so you can enjoy the dazzling effects of your journey through the tubes” (Atari 1981c, 14, emphasis in original). We say “machine operator” here rather than “player” because Demonstration Mode is not really a play mode and in fact requires the locked machine cabinet to be opened and the N13 switch assembly settings to be changed (Atari 1981c, 12). As the upright cabinet’s *Operation, Maintenance and Service Manual* explains, “The **Demonstration Mode** allows you to accelerate through 98 tubes by blasting down the tube toward the far rim without having to kill the enemies” (Atari 1981c, 14, emphasis in original). Demonstration Mode effectively removes many of the game’s ludic qualities and instead offers a travel narrative in which the tubes individually and in sum are made available for perusal, reflection, and enjoyment. The freeze option highlights and intensifies this sensibility, creating time in addition to space for the appreciation and contemplation of the journey through the tubes’ alien landscapes. Such appreciation and contemplation of game imagery and geographic progress have now become commonplace: today, tools abound for players and developers alike who wish to step through or stop altogether the unfolding of a game’s play, from non-game software for screen capture and sharing (e.g., Beepa Pty Ltd.’s *Frapz* [2012]), to games that come with their own image recording capabilities (e.g., *The Movies* [2005]).

Another of *Tempest's* innovative design elements is the “Operator-Information Display” (OID), an operator-selectable screen that, in addition to providing general information about the machine (e.g., pricing, settings, and so forth), includes usage data such as run time versus play time, total

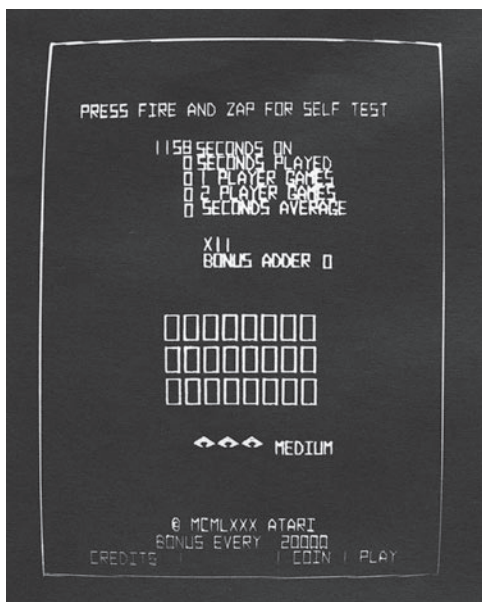


Fig. 11. Operator-Information Display

number of games played (single and multi-player), and average game time. These data would have been invaluable for arcade owners by helping them optimize the machine's profitability.²⁴ More interesting, though, is Atari's acknowledgment of the importance of game metadata, that is, of building into the machine itself tools for understanding player use and engagement. Such metadata not only articulate the study of play with the act of play, suggesting their inseparability and perhaps even equivalency (something game scholars today are now starting to explore more fully), but also foreshadow the importance of data collection to 21st-century game development and play. As a matter of course, 21st-century game developers build advanced data collectors into their games as a way to improve game performance (through bug tracking and game balance adjustment) and enhance development on content expansions and future projects. Concomitantly, today's games often display these data to players directly in the form of immediate and aggregate play statistics (e.g., total play time and top score per character class in *Team Fortress 2* [2007]) as a way to enhance the play experience and stimulate user-defined play objectives (e.g., moving up the ranked leader board in *Call of Duty: Black Ops* [2010]). That *Tempest* prefigured in 1981 these now commonplace ways of doing both game development and gameplay is remarkable.

Atari also directed *Tempest*'s data collection and analysis tools toward the game's hardware itself. In addition to displaying player usage information, the OID showed the results of a two-part "Self-Test Procedure" that enabled operators to quickly discern the game's current settings (e.g., default difficulty setting, language, multi-coin bonuses), as well as information about the hardware's soundness. Using both video and audio signals, the OID was able to pinpoint specific RAM and ROM chips that were bad, the presence of a failing mathbox, misaligned video pots, and other deteriorating or dead components. While not the first arcade game to have such self-diagnostic tools—Atari's *Avalanche* (among others) had simpler ones as early as 1978—it was innovations such as this that helped Atari dominate the video game marketplace. Such attention to the needs of players, machine owners, and service technicians alike emphasized in its time and illustrates for scholars today that by 1981 Atari had already become a mature full-service entertainment company. From this perspective, *Tempest* stands as an icon not only because of its unique game design but also because it represents an early high point of industrial sophistication. As the social space of the arcade became sedimented in 1980s popular culture, game companies had to expand beyond simple game design into full-blown manufacturing and maintenance outfits. Attendant with such expansion and public exposure was the need for machines to be repairable on-site, not only because of the expense of shipping such large hardware back to the manufacturer or calling in a local specialized repair person, but also because every moment a popular game like *Tempest* was out of service meant significant lost revenue. Arcade history scholar Carly A. Kocurek suggests that, conservatively, beginning-to-intermediate players pay about \$8.00 to \$12.00 (US) per hour to game on their favorite arcade machines (2012, 193). She also notes that in 1982, an average arcade machine earned between \$90.00 and \$100.00 a week, or about \$14.00 day. Considering that *Tempest* was no average game, the expense of having such a destination machine out of commission in one's arcade would likely have meant the difference between paying off the cost of that machine in a year instead of several months (2012, 197). Since a standard full-size upright *Tempest* machine listed at the time of release for \$2,295, the average machine would have paid for itself in about six months. Given that *Tempest* was among the top-grossing arcade machines for at least its first year (see above), a conservative estimate of *Tempest*'s coin-drop revenues is about \$2 million (US) per week (twenty thousand pre-release machines × \$100/wk) or nearly \$104 million (US) in its first year. Add the estimated \$46 million (US) in pre-release

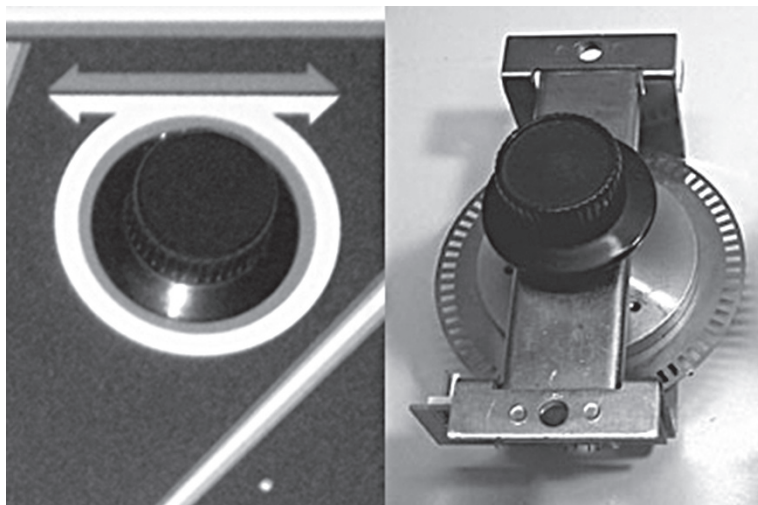


Fig. 13. Spinner

machine sales and the reason for Atari's explosive growth becomes clear: one title alone could conceivably gross more than \$150 million (US) per year.²⁵ In the year following *Tempest's* release, Atari released approximately fifteen different arcade machines, including such classics as *Xevious*, *Dig Dug*, *Gravitar*, and *Pole Position*, which equates to a considerable amount of gross revenue for the company and the people who purchased its machines. In fact, the June 15, 1981, issue of *Business Week* reported that Atari's 1980 annual revenue had topped \$425 million, suggesting that until the 1983–84 game industry crash, the company was doing very well—thanks in part to *Tempest* (“Atari's Bet,” 1981). By developing and consistently enhancing its OID, Atari maximized its games' uptime and thus the company's positive revenue stream—Atari games could be counted on by machine purchasers for easy monitoring and repair.

We would be remiss in our discussion of *Tempest's* innovations if we did not at least touch on the predominant mechanical interface to the game: the control knob or “spinner.” Again, while not the first game to use this technology—Atari's 1972 arcade game *PONG* used a similar device as part of its paddle interface, as did the Magnavox Odyssey home console system—through a number of engineering developments, *Tempest's* spinner became one of the game's signatures. With seventy-two teeth on an encoder-wheel that spun on nylon upper and lower bearings lubricated

with a specially formulated gel, the *Tempest* spinner was fast, responsive, and thus ultimately a significant contributor to what made the game enjoyable. It provided precise, instantaneous, and at that time, virtually unrivaled control of the shooter. As such, it set the stage for a host of other high-performance encoder-wheel-dependent and commercially successful arcade games, from *Pole Position* (1982) to *Discs of Tron* (1983) to *Arkanoid* (1986).

Tempest Fugit

In this chapter we have explored how *Tempest's* aesthetics, technologies, and play logics were not only innovative for the time but have also extended forward through the decades, influencing how subsequent games look (through popularizing three-dimensionality), function (through the collection of data about players and play), and play (through the implementation of choice in difficulty level, the indirect narrativization of its play, and the physical interface's somataesthetic effects). In the coming chapters we probe these qualities and their epiphenomena more deeply, drawing out and contextualizing *Tempest's* intrinsic structures and extrinsic contributions to the life of the video game medium. To help prepare for this work, and in particular for our discussion of genre in chapter 2, it will be useful to extend the close observations of this chapter with some explication.

Tempest's visual design is notable for its simultaneous abstraction, futurism, and classicism. The game itself is not conventionally representational, and yet it deploys Euclidean geometries and the classical one-point linear perspective developed during the Italian Renaissance. In this sense, *Tempest* is allusory without being referential, that is, it suggests a specific intertext—in this case, ancient Greek and renaissance European art and architecture—without necessarily evoking it. This is distinctive from most of the game's contemporaries, which, as we detailed above, relied on direct visual, aural, and titular references to encourage identification and mitigate the abstraction associated with the day's technical limitations. *Tempest's* allusions are not just classical, however; they are also futuristic. The game both participates in Hollywood's growing obsession with wireframe graphics (and their instant mass association with cutting-edge technologies) in the 1970s and 1980s and hypothesizes the sorts of innovative and purposely presentational or counterrepresentational game spaces that would appear decades later (e.g., in the playfields of *Cubivore* [2002] and *Stretch Panic* [2001]).²⁶

But *Tempest* designer Dave Theurer was doing more than mimicking Tinseltown's love affair with special effects, and more than merely symbolizing the mathematics of shape and landscape. He was also probing the surface and depth of the screen itself. Play in *Tempest* is predominantly confined to on-screen space. Not only is the shooter pinned to the tube in play (and, more precisely and finitely, to the near rim of the tube), but there is no diegetic action—action within the play space specifically—that occurs beyond the tube itself, save that associated with the vanishing point out of which the enemies emerge.²⁷ In contrast to games such as *Asteroids* and *Pac-Man*, which purposely exceed the visible limits of the screen by allowing avatar transit off-screen and making such movement part of successful play, *Tempest* disavows the possibility of navigating that which is unseen but present.²⁸

To be sure, the game's enemies emerge from somewhere and the transit from one tube to the next implies additional space—what we might call deep Z-space—beyond the visible scene, but neither of these implied spaces is strategically accessible to the player.²⁹ When on or in a tube, the shooter is visible and controllable. After leaving the tube and transitioning to the next one, the shooter disappears, and there is nothing for the player to control and no distinctive playfield to navigate. Indeed, it is a moment and a topography that acknowledge the potential depthlessness of the screen while at the same time obviating the surfeit of meaning such a space might potentially provoke. Theurer is exploring how deep the screen goes, and thus the game is also a meditation on play and movement in terms of the limitations of a bounded visual field. In this sense, *Tempest* recalls some of the ways in which film and television often use off-screen space to explore and transcend the space framed by the camera's limited ability to capture space.³⁰

In essence, then, Theurer's simultaneous probing of surface and depth is both expressive and theoretical. It is a playful and artistic experimentation with the sense-making possibilities of the medium, and at the same time a study of one of the key sensibilities these possibilities produce: immersion. The inviolable fixity of *Tempest's* tubes and the subsequent breaking of that fixity during the transition between them points to contiguous (and even contradictory) states of immersion:

On the one hand, immersion denotes the idea of envelopment, of being completely and inescapably surrounded. . . . [Games try to] attend to the player's sensorium by appearing everywhere, aurally

as well as visually (and kinaesthetically too in the game itself). On the other hand, immersion can also be expressly agential, sometimes violently so, involving thrusting something into something else as in hot metal into cold water or cold hands into a hot bath. . . . So, “immersion” conjures both the ubiquity of being surrounded and the act of achieving that state—arguably two very different phenomena in the kinds of meanings they produce and enable. (Ruggill 2009)³¹

With *Tempest*, Theurer is offering an early and intriguing commentary on the role of these two states in computer game design and play. For him, the states form a dialectic, and it is in their mutual constitution and inflection that the medium reveals its particular expressive power. We now look to this expressive power as it is manifested in genre and explore *Tempest*'s connections to its precursors and antecedents.

A Genealogy of *Tempest*

Tempest's aesthetic and technological innovations are only part of what make it a landmark video game. Equally important but perhaps less readily tangible is the historical and expressive context out of which these innovations emerged. Video games were already richly commercialized and artistically developed by the time *Tempest* was released, and Theurer's game unquestionably bears the marks of this context, as we illustrate in chapter 3. By the same token, *Tempest* altered subsequent notions of game design and interaction, simultaneously transforming and reiterating what it meant to play with computers. In order to understand *Tempest* as an iconic game, therefore, it is essential to apprehend the creative and industrial palettes it both drew from and produced.

Toward that end, this chapter and the next contextualize from different perspectives *Tempest's* visual and ludic design in terms of the conventions the game built on, established, and promulgated. In chapter 3, we offer a contextual map that considers *Tempest's* place specifically within arcades of its day, that is, the machines and the zeitgeist that surrounded *Tempest* when gamers walked into their local bowling alley, bar, or convenience store. In this chapter, by contrast, we focus primarily on the question of genre and draw out the general aesthetics, storytelling techniques, and play possibilities *Tempest* initiated, reinscribed, and expanded upon. We begin by tracing the game's foundations to the shooting and survival logics of its generic predecessors. We then examine its innovations as they have come to mean in later games and across a diversity of genres. Principally, we consider the conventions of the "Shoot 'Em Up" and "Abstract" genres (Wolf 2001a, 131), the game's mutable play system, the Superzapper as a hyper-ludic

weapon, the emphasis on three-dimensional gameplay, and the cabinet's distinctive physical interface. In sum, we argue that *Tempest* was a generic hybrid whose ways of making meaning echo through the subsequent history of game design right up to today.

A Few Words on Genre

Before beginning our genealogy of *Tempest*, we need briefly to comment on the concept of genre and its critical utility. Of all the theoretical tools available for textual analysis, none may be more important—and frustrating—than genre. It is unquestionably an apparatus of immense power, enabling the comparison of formal, narratological, industrial, and use patterns across time and space. At the same time, it is a construct of intense challenge and often reveals intractable and incommensurable differences instead of articulation and agreement. Its power and problematics flow precisely from the dynamism of human creativity and the fact that new expressions and analyses of the human condition are always emerging and inflecting extant ways of understanding. As a result, the notion of genre is inevitably and simultaneously clarifying and obfuscating, invaluable and worthless.

To maximize the utility of the concept for the purpose of this book, we proceed from Mark J. P. Wolf's 2001 exploration and taxonomy of game genres, "Genre and the Video Game." While scholars have been formulating and refining genre theory generally since the time of the ancient Greeks, Wolf's work is particularly helpful because of its focus, pragmatism, and reflexivity.¹ For starters, Wolf's taxonomy is one of the first and also most elaborate in video game studies, containing forty-two separate categories ranging from Abstract to Utility games. The taxonomy is modeled on the Library of Congress's *Moving Image Genre-Form Guide* and thus reflects a highly practical typology for the functional storage and rapid retrieval of information by experts and non-experts alike. In this sense, Wolf's taxonomy is not meant so much to reveal the play and variety of game styles as it is to be a finding aid and organizational tool for gaining basic and functional intellectual and physical control over a medium. In other words, it is a working schema, not a theoretical one; it is meant to be deployed, not just debated. Such a construct is essential for a project like ours that seeks to demarcate the landmark qualities of a specific game.

At the same time, Wolf clearly understands and appreciates the conceptual problematics of genre:

The idea of genre has not been without difficulties, such as defining what exactly constitutes a genre, overlaps between genres, and the fact that genres are always in flux as long as new works are being produced. And genre study differs from one medium to the next. (2001a, 113)

His taxonomy is offered expressly with these difficulties in mind, not as a complete accounting but as a representative database and rule-set upon which to build knowledge and technique.

This is not to say, of course, that using Wolf's schema is straightforward. The advantages we enumerate above are also disadvantages. For example, the precision with which Wolf delimits his genres means that they are almost never capable of fully containing anything. As we have argued elsewhere, video games are extremely plastic and indeed often idiosyncratic and irreconcilable (Ruggill and McAllister 2011b). It is difficult to compare one game to another and thus organize them according to shared characteristics because they tend to differ so dramatically in their technologies, play mechanics, and meaning-making devices. Similarly, as Wolf himself points out, it is not uncommon for games to occupy multiple genres at once:

Due to the different types of action and objectives that can occur in a single game, games can often be cross-listed in two or more genres. Also, some games, like *M*A*S*H* (1983) or *Star Wars: Rebel Assault* (1993), feature different sequences or scenarios, each of which can be categorized into different genres. (Wolf 2001a, 166)

This introduces an order of complexity into an organizational system ideally meant to simplify things and effectively winds up encumbering the agility of the system. Finally, by Wolf's own admission, categorizing games in terms of their "interactive experience" (2001a, 113)—however important—is only part of the interpretive process. "[W]hen one is attempting to categorize video games," he explains, "genres based on interactivity can be used in conjunction with the existing taxonomy of iconographically or thematically based genres (like those of film)" (116). It is only through the application of multiple critical and organizational lenses, Wolf seems to be saying, that games can be understood thoroughly enough to be effectively categorized, an admission that further qualifies the utility of his taxonomy.

That said, Wolf's sense of the principal forces in games at times seems

to push at the foundation of his model—“the interaction required by the game’s primary objective” (2001a, 116)—and as a result his genres often incorporate iconographic and thematic elements as well as the interactive ones he wants to focus on. In other words, his model is subtly multivalent and multidisciplinary and consequently answers his own call for synthesis. For example, the first genre he delimits—Abstract games—begins with an aesthetic description: “Games which have nonrepresentational graphics” (2001a, 117). Rather than vitiate the concept of “interaction”—in Wolf’s words, “the activity by which a player gains points and advances levels” (2001a, 115)—the inclusion of what amounts to both an iconographic and thematic description highlights the fundamental and complex relationship between interaction, aesthetics, and narrative. In games—as indeed in many media—the doing is often directly related to the seeing. One’s interactions with the game world are profoundly shaped by how it looks (and vice versa). Thus, even though Wolf works hard to isolate interactivity in order to transcend “the inadequacy of classification by iconography” (ibid.), he winds up strengthening the various formal connections that define how games make meaning. Consequently, his model exceeds its impetus, producing a more pragmatically challenging yet theoretically robust conceptualization of how to categorize games.

It is with an eye toward the strengths and limitations of Wolf’s model—in particular its exceptional nuance, which demands an investment in both a broad and deep interdisciplinary approach—and the innate complexity and diversity of the video game medium, that we now move on to a genealogy of *Tempest* and analyze the context of the game as it emerged and became popular, as well as the context it bequeathed to its successors.

The Abstract Shoot ‘Em Up

According to Wolf’s generic system, *Tempest* is both an Abstract game and a Shoot ‘Em Up. Abstract games typically have “nonrepresentational graphics and often involve an objective which is not oriented or organized as a narrative” (2001a, 117), while Shoot ‘Em Ups “involve shooting at, and often destroying, a series of opponents or objects” (2001a, 131). Exemplary Abstract games from Wolf’s taxonomy include *Breakout* (1976), *Marble Madness* (1984), *Q*bert* (1982), and *Qix* (1981); exemplary Shoot ‘Em Ups include *Centipede* (1981), *Galaga* (1981), *Robotron: 2084* (1982), and *Zaxxon* (1982).

Recalling our discussion of aesthetics and play logics from chapter 1, *Tempest* is fairly abstract in its visual design. While there is a consistent logic

to the layout of its playfields—each tube is comprised of sixteen line segments running along the z-axis and connected at their termini by smaller line segments, creating the illusion of depth and three-dimensionality—it is a logic of abstraction. Not only is the geometry underpinning the tubes essentially a visualization of a mathematical abstraction of space (to invoke yet another sense of the term “abstraction”), but the tubes themselves—and their repetition as a set every sixteen levels—are at the same time consistent and varied in their representation of Theurer’s initial dream of depth, terror, and pursuit. More simply, the tubes are the same only different (as are the sets of tubes, which contain the same shapes in the same order but are rendered in different colors). As a result, whatever the tubes might represent initially—geometric principles, Theueur’s dream, minimally resource-intensive computing, the capabilities of a new color vector display, an arcade experience fully worth the price of play—is ultimately replaced by the tubes themselves as they are repeated over the game’s ninety-nine levels. They become the signifier and referent both. Put another way, the tubes are recursive significations, at once recalling themselves and diverging from those recollections every level and every set. The only thing about *Tempest*’s playfield that is “deliberately representational” (2001a, 117), to use Wolf’s term for non-Abstract games, is the emphasis on and modeling of change.²

At the same time, this abstraction is complemented by more concrete and conventional modes of meaning-making. There is the game’s star field and perceived movement through it, for example, which unmistakably recall the cinematic and televisual depictions of outer space popularized by *Star Trek*, *Star Wars*, and other science fiction shows and series of the 1960s and 1970s. The star field also serves as an inter-level transition and break in gameplay.³ As James Newman explains, such interstices offer respite from the frenzy of play and create opportunities for reflection and thus the production and reinforcement of a sense of continuity, progression, and narrative. According to Newman, “the inter-level break provides a time during which the player can assess their performance, lament missed opportunities, or congratulate themselves on a job well done” (2004, 87). In other words, inter-level breaks are often where the story of gameplay—the organization and sense-making of player and developer actions and inactions—are codified. And there is most definitely a story to *Tempest*, albeit a simple and skeletal one: greater challenges await the willing player—as do greater rewards in the form of a higher score, additional shooters, and new levels to experience—in discrete, extraterrestrial spaces. There are tropes of

danger, violence, destruction, escape, commendation, and more, but the story is highly specific and linear. In fact, this specificity and linearity are announced overtly after the coin drop is activated and the game enters “ready to play” mode. In this mode, the player is presented with a putative spectrum of entry points—of beginnings to the story, essentially—ranging from “Novice” to “Expert.” One can choose the path of the rank amateur, the seasoned veteran, or the hardcore player. Despite this range of multiple interpellative and narrative beginnings, however, *Tempest* is structured such that the player can only ever be part of a storyline that details an evolution of personal growth from relative novitiate (even if one starts on “Expert,” the difficulty level is quite low in terms of the game as a whole) to journeyman. One cannot revisit past tubes, circumvent upcoming ones, start beyond tube 11, or in fact do anything other than advance from one level to the next sequentially (save deciding not to accede to the game’s demands and watching the shooter be destroyed). For such a visually abstract game, the story is surprisingly non-abstract in its parameters, representations, and repetitions. It has one arc, one way of unfolding, and, for the most part, one ending: the destruction of the shooter.

As we noted above, *Tempest* is also a Shoot ‘Em Up. The game’s principal play objective is to clear the playfield of enemies by attacking them, either with the primary weapon or the Superzapper. In fact, it is impossible to survive even the first level without doing so, as the Flippers—the first enemies to appear in the first tube—will eventually reach the near end of the tube and pursue the shooter until it or they are destroyed. In this respect, *Tempest* reproduces the logics and design of the archetypal Shoot ‘Em Up. Like *Asteroids* (1979), *Space Invaders* (1978), and *Galaxian* (1979), for example, *Tempest* forces participation by bringing the action to the player. There is no escape from conflict with the enemy, regardless of a player’s personal play style, goals, or desire. Eventually (and typically quickly) the shooter will be eliminated by one of the game’s manifold threats.

Tempest intensifies this ineluctability, this unavoidable trajectory toward combat, through the implementation of its playfields. The tubes are a visual representation of the drive to conflict. Their clearly demarcated and inescapable boundaries keep the tantalizing possibilities of off-screen space (Where are the enemies coming from? What lies beyond the borders of the tubes?) and its potential freedoms (e.g., escape, aversion, pacifism) at bay, concentrating and overdetermining the inevitable strife in the visible and contained geometries of the tubes. The only escape from this containment and channeling into conflict is the transition from one tube to the next,

which of course reinscribes the conditions of play and the impending clash. More precisely, off-screen space is simply a path to more challenging and equally contained on-screen encounters.

Tempest similarly borrows the evaluation metrics and play conditions of its Shoot 'Em Up predecessors. As with *Asteroids* or *Space Attack* (1979), for example, the player's score is principally a factor of threats neutralized (or, in the case of the spikes that the Spikers leave behind, potential threats diminished).⁴ There is no bonus for threats avoided, speed of level completion, hit percentage, or the like. Likewise, there is no game clock, and the only time pressure is that imposed by the number of enemies on the screen and thus the number of successful player actions required to survive at a given moment. Finally, the game's levels get progressively harder. In addition to the emergence of new enemies over the first set of tubes, enemies in general appear more quickly, there tend to be more of them on screen at any given time, and they work more diligently to trap and terminate the shooter. As in *Space Invaders* and *Galaxian*, score is also an index of level achieved, of difficulties mastered. It is a measure of accomplishment that directly reflects a narrative of progress and also of time spent with the machine.⁵

Just as *Tempest* diverges from (and also exemplifies) the qualities of the Abstract game, so too does it play with the conventions of the Shoot 'Em Up, at least as they were embodied in the late 1970s. Principally, this is due to the game's abstract imagery. Prior to *Tempest*, Shoot 'Em Ups typically attempted to pull from and reproduce easily recognizable semiotic domains from popular culture (e.g., outer space, the old west, naval machinery, and warfare). These domains might be referenced in a game's title (e.g., *Cosmic Monsters* [1979]), depicted in the diegesis (e.g., the battleship and submarines of *Deep Scan* [1979]), or appear as cabinet art (e.g., *Astro Wars* [1979]), and they functioned to 1) mitigate the graphical and computational limitations of the day's technology, 2) evoke a play world that could be easily entered without the need for much backstory (and thus offer an immediate experience for money deposited in the machine), and 3) call out to potential players from within a sea of distractions (e.g., other machines, players, activities). More importantly, these domains accessed parts of the popular cultural fund that had come to emphasize combat, survival, or both: alien invasions, inhospitable landscapes, interplanetary exploration, and so forth. Consequently, *Tempest's* antecedents were designed to overdetermine and expedite a specific immersive play experience.

Tempest, by contrast, is generally more oblique in the sign systems it

references. As we described in chapter 1, the visual design of the game flows from Euclidean geometries and Italian Renaissance one-point linear perspective, with math-derived shapes and a classical apportioning of space. However, the game does not specifically evoke this particular intertext. There are no visual, aural, or even interactive elements that concretely express a Greco-Roman typology of signs, symbols, and ideologies. Rather, *Tempest's* connections to Ancient Greece and the Italian Renaissance are indirect and subtle, allusory more than overt. The intellectual and aesthetic articulation to those eras is there, certainly, but not as shorthand and not as a way to inject the player into an instant and nearly viscerally recognizable environment. In this respect, *Tempest* is almost anachronistic, or displaced in time, compared to its predecessors. Unlike *Space Wars* (1977), for example, in which there is a direct temporal, spatial, and aesthetic connection to the world of the *Star Trek* television series—one of the ships in the game is clearly patterned after the U.S.S. *Enterprise*—*Tempest* is largely disconnected from the iconographies of Ptolemaic Greece and 14th- and 15th-century Italy. One would be hard pressed, in fact, to place it aesthetically or thematically in either of those eras, or even contiguously to them. The game is far too abstract and futuristic, as well as arepresentational.

And yet, *Tempest's* logics are also clearly derived from those eras' conceptions of space and their artistic and symbolic representation. There is the symmetrical perfection of the vanishing point, for example, and its symbolic as well as practical importance to the work and its narrative: in *Tempest*, the vanishing point is the place from which threats emerge (and is thus the source of play, if not its locus) and where the avatar must travel eventually. There are also the singular geometries of the playfields and their occupants, which embody—in an updated and fantastical way, obviously—a number of Euclidean principles and axioms (e.g., “Things which are halves of the same thing, or of equal things, are equal to one another” [Hall and Stevens, 7]). In essence, then, *Tempest* both calls out to and distanciates its thematic and iconographic origins, venerating them without necessarily depending on them for semiotic and narrative weight. The result is a generic object that simultaneously reifies and disturbs the stylistic conventions of the genres it primarily occupies, the Shoot 'Em Up and the Abstract game.

One final example of this paradox, and a means of transitioning from our discussion of *Tempest's* genealogy to an exploration of the game as a harbinger, can be found in the relationship between the software's aesthetics and the promotional/decorative designs applied to the cabinet that



Fig. 14. *Tempest* cabinet/side art aliens (Tempest © 1981 Atari Interactive. All Rights Reserved. Tempest is a trademark owned by Atari Interactive, Inc. Use of Tempest images and trademark are provided under license by Atari Interactive, Inc.)

houses them. In contrast to the abstraction of the game itself, the cabinet art is fairly concrete, illustrating what appears to be a clutch of malevolent, humanoid aliens materializing in outer space.⁶

In keeping with the tradition of the Shoot 'Em Up, one might reasonably conclude from the cabinet that *Tempest* involves a confrontation with these aliens, and to a certain extent this is the case. As we documented above, conflict is key to the game's play, and there is a definite and persistent malevolence to the game's enemies. They seek confrontation even if the player does not. However, there is also an aesthetic disjunction between what the cabinet artwork suggests and what the game delivers: the shape of the avatar matches that of the outstretched claw of the proximate and most prominent alien displayed on the cabinet, which works to complicate rather than clarify the narrative of threat and defense underpinning the game's play. Is the player defending against an invasion—as the hostile aliens on the cabinet would seem to suggest—or part of one, given the graphic match between the avatar and the alien claw? Alternatively, is the player fighting against an external threat—an alien horde—or engaged in a civil war with fellow creatures? Either way, the answer is unclear; as a result, the cabinet artwork winds up being both representative of the game and also not so. It depicts an inhuman menace but does not clearly position the avatar (and by extension, the player) in terms of that menace. In effect, the cabinet hails the player into a game world that is then problematized rather than reified by the game itself, something quite unusual for games at that time though more common today (e.g., game boxes or trailers that highlight set pieces or play segments that turn out to be only incidental to the game's overall play and narrative experience).

Tempest broke with tradition in other ways too. In playing with con-

vention, it also established it, offering stylistic and play elements that are now part of the everyday of video game design and play. In the following section, we discuss a number of these elements and their echoes in game history and culture, focusing primarily on *Tempest* as a harbinger of 1) new player-game relations, 2) an ideological and narrative deepening of the screen, and 3) a more elastic game environment.

Tempest as Genre

In chapter 1, we outlined and contextualized *Tempest's* innovations principally in terms of the Atari coin-operated line. It was a unique game for the company and debuted a number of new technologies (e.g., the Wells-Gardner Color X-Y Display vector-generator monitor) and approaches to play (e.g., the user-selected starting level). Part of what makes *Tempest* a landmark game, however, is the resonance these innovations had beyond Atari's machines and the arcades that contained them. A case in point: today's ubiquitous three-dimensional video gameplay owes much to *Tempest's* surprising success. The game showed that the illusion of depth—even in a non-representational setting—could be highly commercial, something earlier games (e.g., *Night Driver* [1976]) were not able to do quite so convincingly.⁷ While previous titles offered three-dimensional play, *Tempest* was able to do so on a grand and commercially successful scale. It was a popularizer of the perspective, and thus a progenitor.

At the same time, *Tempest* also toyed with the aesthetic and ideological possibilities of three-dimensional play, appearing to offer both a bounded and an open play space. On the one hand, the game's avatar is expressed as a fully rendered, two-dimensional object located on the edge of a three-dimensional playfield. We say "fully rendered" here because there are no obvious in-game audio-visual articulations between the avatar and an off-screen object or host. The yellow, simple, non-convex, eight-sided polygon of the shooter appears as a discrete, on-screen object whose relationship with other objects in the game—enemies, their attacks, and the playfields on which the action occurs—is organized solely in terms of the game's collision detection system as it is manifested on-screen. More simply, *Tempest* offers a third-person point of view of the game world, a point of view that encapsulates the action.

On the other hand, the cabinet artwork implies that the avatar is not a discrete object but perhaps the visible terminus of an alien being that exists off-screen (i.e., the disembodied hand common to the first-person shooter).

The graphic match of the shooter and the claw of the most prominent alien depicted on the cabinet creates a visual dynamic that locates the avatar beyond the screen, in the physical space of the player. In this case, the shooter is not a discrete object at all but a part of something larger, an embodiment of agency positioned as the player (or at the very least in the same extra-machinic space as the player). In other words, *Tempest* also seems to present a first-person view of the game world, with the player effectively reaching into or being surrounded by the space of the tubes.

This multiperspectivalism is noteworthy for several reasons. From a generic perspective, the articulation of multiple ways of seeing has become almost elemental to game design and play. The practice of deploying differently accessible possibility spaces within a single game is today virtually ubiquitous, with titles of all sorts overtly engaging their players on a variety of visual and immersive levels. First-person shooters such as *Halo: Combat Evolved* (2001) and *Borderlands* (2009), for example, often include third-person play segments in which players drive vehicles or do other game work in addition to that required by the primary game mode (i.e., shooting). Similarly, many predominantly third-person genres such as platformers have first-person play as well (e.g., *Billy Hatcher and the Giant Egg* [2003], *SpongeBob SquarePants: Battle for Bikini Bottom* [2003]), not to mention the option for the player to move between third- and first-person perspectives in order to get a better look at something or target an object (e.g., *Ratchet & Clank: Going Commando* [2003]).

From an industry standpoint, the reason for multivalent play seems straightforward: diversifying the play experience can help increase seat time (i.e., the amount of time a player spends with a game), broaden the game's potential audience, and combat player desire for new experiences (and thus new games). Similarly, from a design standpoint, multiple player perspectives enable different means of storytelling and therefore additional opportunities for player engagement, reflection, and sense-making. Simply put, what was implied but inchoate in *Tempest* is now a well-defined and well-used commercial, aesthetic, and interactive instrument.

In chapter 1, we unpacked the novelty of *Tempest's* Skill-Step play system. That vision of player-game relations and dynamism bears further discussion here because play customization has become nearly intrinsic to the video game medium. Indeed, it is rare to find a game today that does not invite the player to personalize the play experience in some way, from selecting play difficulty (e.g., *Gears of War 3* [2011]) to customizing an avatar's appearance and item loadout (e.g., *Army of Two* [2008]) to choosing

how to engage with NPCs and the narrative framework generally (e.g., *Fable II* [2008]). Games have become pointedly dialectical, expressly asking players to collaborate directly with developers on the end experience.⁸ True, games of all kinds (computer-mediated and otherwise) are inherently multi-authorial, for without player action, choice, and style there can be no game.⁹ However, there is a distinct difference between playing within the rules of a game and changing them outright. Imagine if a professional soccer match were to begin with the players choosing the match's difficulty level or being given the option to significantly personalize the play equipment. And yet, this is precisely what video games now often do: they invite players to express themselves through game structure, not just in gameplay. In the wake of *Tempest's* Skill-Step system, player authorship—not merely the playful collaboration between developer and player found in any game—has become a basal part of the design and play experience.

Tempest's Superzapper, too, reverberates through video game history and design. It is an obvious and primal implementation of the hyper-ludic weapon, a leitmotif of the Shoot 'Em Up (e.g., *DOOM's* BFG 9000 [1993], *Gears of War's* Hammer of Dawn [2006]). As Steven Conway notes, video games often “maintain varying degrees of ludicity” (2010, 135), of the potential for gamic objects and playful decisions “to act or have an effect upon the gameworld” (ibid.). Whereas contra-ludic phenomena retard “the capability for action, and thus in many cases the ability [of the player] to be an effective agent within the gamespace” (ibid.), hyper-ludic phenomena enhance the player's power, enabling new forms of and opportunities for agency (albeit often only temporarily). *Tempest's* Superzapper is just such a device: it destroys virtually all on-screen threats with a single deployment and in the process expands the game's playful possibilities. Of importance here is the plasticity the Superzapper enables. It imbues a certain dynamism, a certain fluidity, to the parameters of play. Standard operating procedures (e.g., one shot, one kill) can be upended, which stretches the interactive and meaning-making possibilities of the game. For instance, one need not fear an unstoppable enemy onslaught or cunning trap, both of which are core elements of *Tempest* and the Shoot 'Em Up generally. There is always a simple, powerful, and expeditious solution (provided the player has been skillful, judicious, and lucky, of course): the total and instantaneous annihilation of threat. As Conway explains, “Hyper-ludicity is empowerment. It is an enlargement of effectance and expansion of play” (2010, 143). In the case of the Shoot 'Em Up, the hyper-ludic weapon extends the narrative and agential potential of the principal but limited game

mechanic: shooting. With the Superzapper—or later the BFG 9000 and Hammer of Dawn—shooting and its consequences become extraordinary. They are transformed, as are their experiential, ideological, and narrative implications.

Finally, *Tempest*'s distinctive physical interface—or rather, the illusion of freedom of movement the control-panel knob and its virtually endless spin suggest—foreshadowed the openness common to contemporary play worlds. From sandbox games with their option to ignore structured play objectives in favor of exploration and player-generated goals (e.g., *Grand Theft Auto: San Andreas* [2004]), to MMORPGs with their enormous, changing landscapes and fluid social structures (e.g., *World of Warcraft* [2004]), the video game medium today is abundant with expansive and seemingly open-ended play opportunities. Anything can happen, games today suggest; the medium and its pleasures are boundless.

Needless to say, there is a disconnect between this suggestion and reality. While modern games are undeniably capable of offering vast play, their affordances are yet circumscribed by game engines and the hardware on which they run. The expressive and playful openness on offer are in fact illusory and exist only in terms of what is mechanically possible. Yet, the promise of limitless effectance is integral to how games are often designed and sold. “Play it your way” and “Go anywhere, do anything,” *Far Cry 2*'s (2008) box proclaims, guaranteeing “[o]pen world gameplay [that] gives you total freedom to play the game you want in a world totally without limits.” The appeal here is both paidiac and ludic, to use Roger Caillois's terms, espousing “uncontrolled fantasy” (2001, 13) but in the context of the “effort, patience, [and] skill” a large and complex game requires (ibid.). *Tempest* made similar appeals decades ago, its bidirectional and seemingly frictionless control knob heralding the possibility of a transcendent mediated experience. That is, *Tempest* demonstrated that even the most constricted and limited of play spaces could offer the willing player a sense of “total freedom,” even if the reality was something quite different.

Conclusion

In this chapter, we have focused on teasing out the generic conventions *Tempest* embodied, expanded upon, and initiated. We used as our base, Wolf's taxonomy of game genres, arguing for it as a robust, precise, and surprisingly nuanced classificatory instrument despite its limitations and the general difficulty of grouping video games by genre. We then applied

this instrument to *Tempest* directly via the Abstract and Shoot 'Em Up genres, confirming as well as problematizing the game's aesthetic and interactive heritage. Finally, we discussed *Tempest* as a genre itself—or rather how its once unusual offerings have become pan-generic—and explored the ways the game's relationship to the player, treatment of the screen as portal and display, and physical and aesthetic environment are almost de rigueur today.

Key, now, is to expand the discussion beyond immediate questions of textuality. It is not enough to know in detail *how Tempest* is, but *why* it is. What are the specific material and cultural contexts from which the game's textuality flows? We take up these broader contexts in chapter 3 and work to document the social, cultural, and industrial environment that produced *Tempest* and directly contributed to its landmark iconography and play. As part of this documentation, we also explore the game in terms of designer Dave Theurer's oeuvre and focus on the overarching interactive as well as aesthetic sensibilities of his *Missile Command*.

CHAPTER 3

Contexts

In this chapter, we explore *Tempest's* contexts, describing the larger environment from which the game's distinctive look and feel materialized. We begin by surveying the prominent global and national events of the late 1970s and early 1980s, the years immediately surrounding *Tempest's* development and release. Our logic for this jumping off point is straightforward: as with any human creation, even when specific large-scale events appear absent from a given game, their traces are often detectable in its aesthetics, play mechanics, and objectives. Apprehending *Tempest's* background, therefore, not only helps situate the game as a landmark temporally but also politically, ideologically, and geo-historically.

From these global and national spheres we move to a description of *Tempest's* cultural and marketplace contexts. Our focus in this section is on how designer Dave Theurer and developer Atari adapted the popular culture zeitgeist to produce an experience that was linked just enough to the time period to seem familiar but was also replete with a futurism designed to appeal to the young people who were flooding into arcades in industrialized countries around the world.

We conclude our investigation of *Tempest's* contexts by touching on the play experiences that proximally surrounded the game. Whereas the marketplace context includes the competition for consumers' coins, and the generic context (which we discussed in chapter 2) offers a stylistic genealogy, the interactive context encapsulates how it likely felt to see and play *Tempest* in the midst of the other machines in the arcade.

Importantly, and in contrast and complement to the microscopy, textual fidelity, and artifactual focus of chapters 1 and 2, we work quite broadly in

this chapter, teasing out *Tempest's* intertexts in ways designed to situate and also transcend the game's specific technologies, narrativities, and cultures. We range across both time and space, charting an array of socio-cultural rivulets that converge in *Tempest's* contextual and semiotic stream. We do not attempt to depict this stream precisely or even empirically; that task would be far beyond the scope and *raison d'être* of this book. Rather, we merely mean to articulate some of the notable extra-textual but interconnected energies of *Tempest's* day, energies upon which the game drew, to which it contributed, and that help inform its landmark status.¹

Similarly, we are not claiming here that Theurer was responding directly to the multitude of world events we point out below when he designed *Tempest*. Rather, our aim is to remind readers that the game was created in an incredibly complex socio-political milieu, a context that made its mark in one way or another on everyone and everything within it—including Theurer and his games.² In other words, we do not focus on the game so much as on its surroundings. Because these surroundings were so diverse, we approach them linearly and via a repeated pattern: in each section, we begin two years before (1979) and conclude two years (1983) after the game's release. Our goal with this temporal range is to reasonably condense yet fairly represent the complexity of *Tempest's* global and local contexts.

Global Context

Tempest was aptly named, for it was produced and played during a tempestuous era. In 1979, just two years prior to the game's release, the Vietnamese government unseated Cambodian dictator Pol Pot and the Khmer Rouge National Army, events that triggered China's invasion of northern Vietnam and the start of the Sino-Vietnamese War. At the same time, the Middle East was erupting in response to the rise of Ayatollah Khomeini and his Council of Islamic Revolution. Embroiled in this political miasma were Iran, Afghanistan, Chad, Iraq, Russia, the United States, Israel, and Libya, among others. Other notable geopolitical headlines from 1979 include a vote for home rule in Scotland (repelling, at least on paper, the invading English), a coup in Grenada (repelling an authoritarian government), continued violence between protestants and Roman Catholics in England and Ireland, and the Iran Hostage Crisis. In the year leading up to *Tempest's* design, in other words, any reasonably informed American likely would have been attuned to and concerned with the Earth's geopolitical

instability.³ Concomitantly, it is easy to imagine a psycho-political dynamic influencing the explosive growth in video game arcade culture, and why the home console market had become the next frontier for consumer electronics companies to conquer: people were increasingly looking to escape the escalating woes of the world.

The year 1980 began with US president Jimmy Carter establishing a grain embargo against the Soviet Union in response to the USSR's 1979 invasion of Afghanistan, initiating what some historians call "the second Cold War" (Halliday 1983, 2). Over the next twelve months, tensions and tragedies emanating from this transnational dispute perfused across the globe. Russian nuclear physicist and Nobel Peace Prize winner Andrei Sakharov was arrested in Moscow for his outspoken views against nuclear proliferation, more than four dozen people were killed during a rocket fueling accident at Russia's Plesetsk Cosmodrome, and Polish labor and human rights activist Lech Wałęsa initiated the first of many national strikes that culminated—after much bitter struggle—in the creation of Solidarity, which became one of Poland's largest and most powerful independent trade unions.

Also in 1980, Salvadoran Archbishop Óscar Romero was assassinated by government agents for preaching against the state's repression of its people during the Salvadoran Civil War. One week later, the violence escalated, and at Romero's funeral dozens of people were killed by government-backed sharpshooters. One of these same "death squads," as they became known, soon made headlines again when its members raped and killed three Roman Catholic nuns and lay missionary Jean Donovan, sparking international outrage and an investigation of the Salvadoran government's actions and suspected connection—confirmed several years later—to the US government.

Closer to the United States, Cuba welcomed the leftist guerrillas who had held dozens of people hostage for two months at the Dominican Embassy, even as it allowed upward of 125,000 Cubans—including, it was later discovered, numerous prisoners and people suffering from mental illness—to emigrate to the United States during the Mariel Boatlift. The other major stories in 1980—apart from the Summer Olympics in Moscow that the United States and other countries boycotted—were the start of the Iran-Iraq War (the longest conventional war of the 20th century) and a powerful earthquake in Italy, which killed thousands and left many more homeless. These were the events that gobbled up newspaper columns and the evening news, informing Americans not simply about the state of

affairs elsewhere in the world but also about how information flowed in increasingly rapid and seemingly borderless ways. As Paul Virilio puts it: “With live transmission, local time no longer creates history. Worldwide time does” (Dufrense n.d., para. 18).

The year 1981 was even more intense in many respects. Deadly earthquakes struck China and Greece; there was an attempted military coup of the Spanish government; and Bangladeshi president Ziaur Rahman, Iranian prime minister Mohammad-Javad Bahonar, Iranian president Mohammad-Ali Raja’i, and Egyptian president Anwar Sadat were all assassinated. An assassination attempt was made on Pope John Paul II, South African troops invaded Angola, Israel bombed Beirut and Iraq, and Cuba was struck by a dengue fever epidemic that some suspected was an act of biological warfare perpetrated by the United States. In South London, the race-related Brixton Uprising resulted in hundreds of injuries, and in Chile, Augusto Pinochet, the US-backed dictator who had several thousand insurgents killed during his time in office, was “given” another eight years as leader despite a majority vote against his presidency. The Salvadoran Civil War was punctuated by the El Mozote Massacre in which government troops killed nearly a thousand civilians, and martial law was declared in Poland in order to prevent the Solidarity union from further undermining the Communist regime.

Meanwhile, talks between the United States and the Soviet Union concerning nuclear weapons reductions continued to falter, even as nuclear-related accidents—such as the running aground of a Soviet nuclear-armed submarine in Sweden; the accidental explosion of a Pershing II missile at a US military base in Heilbronn, Germany; and multiple nearly catastrophic NORAD false alarms signaling massive Soviet nuclear attacks on the United States—were on the rise. As globalized information outlets found their footing, one message in particular began to permeate popular culture: human beings are always at war or tottering near its brink. This explains, in part at least, why humans have long played at war, and how the experience of escalating conflict—so heavily and trans-culturally depicted in the televisual age—can be so easily transmuted into entertainment: ironically, war—real and simulated—brings humans together to test their mettle, defend their principles, and strive for the rewards of victory.

By 1982, the year after *Tempest’s* release, small-scale conventional wars the world over were all but ubiquitous, and the superpowers were nearly always involved directly or indirectly: the Falklands War, the First Lebanon War, the Ugandan Civil War, and the Lebanese Civil War, not to mention

the continuing wars and armed skirmishes in Thailand, Burma, Vietnam, Cambodia, Sri Lanka, Laos, the Philippines, Chad, Uganda, and elsewhere. Even as some economies faced collapse (e.g., Mexico, Yugoslavia, Chile), globalization and world trade were intensifying and becoming more tentacular. This latter point is perhaps best exemplified by the General Agreement on Tariffs and Trade (GATT) Ministerial Meeting in Geneva, Switzerland, in November, which laid the groundwork for, among other multilateral trade agreements, resolutions on the transnational protection of intellectual property—including the integrated circuits and software involved in video game production and play.

The period of 1979 to 1982, in other words, was a period of global tumult and confrontation, a period defined precisely by the sorts of clashes and drive to conflict that are central to *Tempest*. In documenting the hypermediated global events of the period just prior to, during, and just after *Tempest*'s release, however, we do not mean to imply an unambiguous correlation between the contents of the news and the practice of game design, distribution, and consumption as they were drawn out in *Tempest*. Rather, we simply mean to point to the global moment within which *Tempest* was designed and played and to suggest that certain of the game's defining qualities—fending off both sneaking and marching invaders with increasingly sophisticated and deadly weapons, for example—are hardly surprising given the day's headlines.

Of course, the era's global news and entertainment media had a potent local component as well, a poultice that offered some comforting domesticity to the psychic injuries sustained in the emergent global media barrage. These homegrown issues, though at times as ominous and destructive as those unfolding elsewhere in the world, also connect to *Tempest*'s appearance and appeal, and it is to this national context that we now turn.

National Context

Leading up to *Tempest*'s release, US citizens were besieged with signs of the country's geopolitical and technological superiority, as well as with threats to this superiority. In early 1979, for example, the *Voyager 1* space probe began sending back spectacular photographs of Jupiter and its moons. At the same time, NASA was preparing for the launch of *Columbia*, the world's first multiple use orbital vehicle and a machine that simultaneously vivified America's flagging space-oriented imagination and fueled anxieties about the Cold War going galactic. Exacerbating these concerns was the

announcement that Skylab, an orbital space station that had been in service since 1973, would soon re-enter Earth's atmosphere and crash to the ground—hopefully not in a major metropolitan area.

Other signs of technological advancement—and the negative consequences such advancement often trows—were also in the news. Even as two major cable networks took shape (Nickelodeon and ESPN) and Paul MacCready and Bryan Allen built and flew a human-powered aircraft across the English Channel, the Chicago, Rock Island, and Pacific Railroad declared bankruptcy, and anti-technology crusader Ted Kazinski—the so-called Unibomber—sent out the first of his many mail bombs. On the computer programming front, the Ada language was released as the de facto coding schema for US government projects, especially those written for the defense industry (e.g., missile guidance systems) and public safety initiatives (e.g., air and rail traffic control, satellite systems, and so forth). This standard, however, was highly controversial and sparked protests by many engineers and scientists who believed its unreliability made it dangerous for safety-critical applications.⁴ The language never took hold for more mundane commercial applications such as video games—it was widely viewed as too complex for commercial use—even though early releases of the development environment included sample code for making a *Tetris*-like game.

As the curtain closed on Jimmy Carter's presidency and opened on Ronald Reagan's, one of the prominent sources of inspiration for the national public was the steady stream of astonishing photographs being sent back from *Voyager 1*. In February of 1980, the space probe took the first high-quality images of Janus, one of Saturn's moons, and in November *Voyager* came within 77,000 miles of the planet's cloud layer. Through pictures reprinted in newspapers across the country, Americans were treated to close-up images of Saturn's famous rings, as well as high-resolution color images of the planet/rings pairing that only weeks before had been the stuff of science fiction.

Other 1980 headlines were grimmer and contributed not to a positive popular impression about space or technology but to the growing cultural anxieties about high-tech war. For example, the Chrysler Corporation—the nation's tenth-largest manufacturing company, a major contributor to the military-industrial complex (e.g., tanks, rockets), and a cornerstone of the automotive industry—came so near to collapse that it required a federal bailout to save the company and preserve thousands of jobs. It was also in 1980 that the draft was reinstated for eighteen- to twenty-five-year-

old males in preparation for potential hostilities with the Soviet Union. Though *Tempest* designer Dave Theurer likely would have narrowly missed being eligible for this peacetime draft due to his age, it is easy to understand why he might have been troubled by images of bombs falling on cities—as in his 1980 game *Missile Command*—but also captivated by notions of outer space.

That the Iran Hostage Crisis was ongoing throughout 1980 only further frayed Americans' nerves, even as a host of natural and environmental disasters instilled fears about everything from vacationing (the MGM Grand Hotel and Casino fire in Las Vegas, Nevada, killed eighty-five people) to the unpredictability of Mother Nature (Mount St. Helens erupted) to the widespread problem of toxic waste in people's backyards (the federal government implemented the Comprehensive Environmental Response, Compensation, and Liability Act, which aimed to reveal and clean up so-called superfund sites). In short, 1980 was a year marked by news of constant attack and insecurity from all quarters: military, environmental, industrial, biological, and technological. This was the zeitgeist within which *Tempest*—a game about fending off varied and constant enemy attacks that can, in effect, shoot, capture, electrocute, and otherwise destroy the player's avatar—was imagined. Thus, while the game's imagery was abstract, the threats it posed to players were almost literally ripped from the headlines.

The years of and immediately following *Tempest's* release were similarly dynamic. On the one hand, the Iran Hostage Crisis came to an end just minutes after Ronald Reagan was sworn into office; the Space Shuttle *Columbia* successfully flew its first mission; the long-awaited design for the Vietnam Veterans Memorial was selected; the first US test-tube baby was born; and Sandra Day O'Connor became the first woman to serve on the US Supreme court—all developments that were generally received by the public as signs of national healing and progress. On the other hand, President Reagan was shot by John Hinckley Jr.; several people were killed during a test of the Space Shuttle *Columbia's* rocket engines; the Centers for Disease Control and Prevention identified the first AIDS cases; and despite Justice O'Connor's presence, the Equal Rights Amendment failed to be ratified by Congress—further evidence that progress begets additional and more difficult challenges.

Notably, this socio-cultural pattern—in which advancement multiplies and amplifies conflict and problems—is fundamental to *Tempest*, and while it was not the first or only game of its era to deploy this mechanic, it certainly reified it via the Skill-Step feature. By presenting players with

an unambiguous set of choices indexed to game levels meant to accustom the play experience to the user's ability, Skill-Step transformed the idea of problem multiplication and amplification from an unarticulated, uncontrollable, yet expected property of the game into a mechanism of self-actualization within (and arguably even beyond) the diegesis.⁵ In other words, Skill-Step extended the idea of problem multiplication and amplification into a doctrine of war preparation, which once committed to, contributed a significant element to how *Tempest* felt to play—one that for all but the best players lasted well past the end of the game in the form of personal reflection: “Would I have made it farther if I had started at an easier level, or should I have started at a harder level to get more practice in advance of the greater challenges yet to come?”

At any rate, the extremes of 1981 continued through 1982. That year, three quarters of a million people gathered in Central Park in New York City for the largest rally against nuclear proliferation in history; the Knoxville World's Fair hosted over eleven million visitors and distributed specially minted game tokens for visitors emblazoned with the likenesses of *Pac-Man* (1980), *Ms. Pac-Man* (1981), *Qix* (1981), *Gorf* (1981), *Space Invaders* (1978), *Scramble* (1981), and *Donkey Kong* (1981); and “Lawn Chair Larry” floated more than three miles into the sky with nothing more than helium balloons tied to a lightweight piece of patio furniture. At the same time, the Unabomber struck again and was also briefly considered a suspect in the Chicago Tylenol murders, lethal injection became the de facto method for killing inmates on death row, and a retired dentist became the first person in history to receive an artificial heart. Perhaps the most important domestic headline of 1982—for the future of computing if not for the video game industry directly—was the breakup of “Ma Bell.” AT&T was disaggregated in response to antitrust proceedings, opening up possibilities for competition in the long-distance marketplace that eventually led to the development and massification of satellite phone and data transmissions.

In a way, the national context for *Tempest* was a microcosm of the game's global context: dynamic, unnerving, and dislocative. One could certainly argue, in fact, this global-local relationship to be self-evident. History and cultural development are fractal—events scale up or down in endless and nearly identical patterns, always influencing and being influenced by other things. This would explain why so many of the national and international events of the time seem to resonate in the look, sound, and feel of *Tempest*, and why elements of *Tempest* are discernible far beyond the arcade (as will become clear below).

Such a systems approach to unpacking *Tempest's* meaning is beyond the purpose of this book in a comprehensive way. Moreover, after a point, it also does not particularly nor effectively help illuminate *Tempest's* status as a landmark video game. Thus instead, we suggest here that the repetition of patterns from global to local is a result of the fact that the United States—the country in which Dave Theurer lived and *Tempest* was born—was a superpower at the time and consequently held the extraordinary capacity to shape the global theater according to local phenomena and ideology. Were this book about *Tetris* (1987)—a game developed by a Soviet computer engineer just a few years after *Tempest*—we would perhaps be making a similar argument about that game's context but from a Russian perspective. Regardless, there is no question that even Americans who were relatively ignorant of global politics would still have been steeped in the paranoia, fear, and antagonistic imaginings that transformed the popular culture of the time. Thus, when Theurer says that *Tempest's* origins lie in a dream he had about monsters climbing out of a hole, it is no great interpretive stretch to say that the game's invaders might represent aliens from outer space (which was newly visible thanks to *Voyager 1* and *Columbia*), Communists (or other enemies, of which the United States seemed to have many), viruses (such as the recently discovered HIV), or technological projects gone wrong (nuclear threats and accidents were proliferating). From a global and national perspective, all of these are quite reasonable interpretations, and we would go so far as to say that they are each true in their way. *Tempest* was conceived, developed, and released in a specific and special environmental salmagundi whose ingredients palpably suffuse the game world.

As we suggested above, we are not discounting the possibility that Theurer did, in fact, dream up (literally) the idea of *Tempest*. Rather, we mean to clarify some of the very real material that might have contributed to the substance of such a dream. Theurer himself has spoken about how his professional goals and responsibilities became entangled with his (understandable) anxiety about nuclear Armageddon in the 1970s and 1980s:

When I did *Missile Command* I lived near Ames Research Center down in Mountain View. They were always sending out these U2 flights, they go straight up and sound like an atomic bomb exploding. I'd hear those things and it would terrify me. And I'd wake up in the middle of the night from a nightmare where I'd see these streaks coming in, and I'd be up in the Santa Cruz mountains and I'd see it

hit Sunnyvale and I'd know I had about 45 seconds until the blast reached me. I had those nightmares once a month for a year after I finished *Missile Command*, I had internalized the game so much while working on it. Having to do all this other stuff raised hell with my personal life, too. If there's anything I could communicate in this interview it is that people should watch out for their personal lives when they get sucked into these projects. It's really seductive and all consuming. My entire existence was creating these games. They're holding out this huge carrot, all the money you're going to make. And it's fun, so you think, OK, if I can just make it for two or three years, then I'll work on my life. I see a lot of that going on now. (Morph 1994, n.p.)

It is also worth noting that Theurer did not merely have voyeuristic familiarity with nuclear hardware. His first job out of college was working as a programmer for Bunker Ramo, a military electronics company. Simon "Si" Ramo, one of the founders of that company, was a major contributor to the development of the Intercontinental Ballistic Missile (ICBM), which became the cornerstone of the nuclear arms race.

There are, of course, other contextual elements worth noting, elements that in some ways speak more immediately and tangibly to how *Tempest* worked and why the public received it so enthusiastically. Specifically, we are thinking of developments in US popular culture, the consumer electronics marketplace, and arcades and home games. The first of these semi-otic domains—US popular culture—is the subject of the next section.

Cultural Context

In 1979, the industrialized world (and the United States especially) was awash in technological developments that both revolutionized communication and seemed to bring the future into the present. Usenet newsgroups, for example, almost instantaneously changed how people with access to the Internet exchanged information. Built on a technology that is arguably the precursor to everything from Web fora and FAQs to blogs, RSS, and Atom aggregators, Usenet newsgroups provided the infrastructure for some of the first online communities. During this same time, Dan Bricklin and Bob Frankston wrote and released VisiCalc, generally considered to be the first spreadsheet application for the microcomputer, the first "killer app," and the software program that put Apple Computer, Inc. (and arguably home

computers generally) on the consumer electronics map. As middle-class buyers began to think seriously that having computers in their homes made sense for both practical (ostensibly) and entertaining (actually) purposes, they were simultaneously exposed to the idea that, through the introduction of the Sony Walkman, their personal music collection could be made mobile. Even as the Walkman and its plethora of portable audio-cassette-playing clones became ubiquitous, Philips and Sony together were testing and standardizing the Compact Disc format that would shortly replace the audio cassette. Notably, as magnetic tape was being phased out for audio purposes, its utility was about to extend many times over in the home movie industry: JVC's VHS format had triumphed over Sony's Betamax, prompting a number of Hollywood studios—including Paramount and Columbia—to reorganize in order to compete in the growing home entertainment (i.e., movies on videotape) market.

Complementing these technologies in orienting consumers to the narrowing gap between future and present, digital and analog, work and play, liminal and liminoid, were a host of television series that offered an unprecedented set of opportunities for viewers to imagine themselves (or at least their descendants) as galactic travelers: *Doctor Who* (1963–89; 2005–2015), *Blake's 7* (1978–1981), *The New Adventures of Flash Gordon* (1979–1982), *Buck Rogers in the 25th Century* (1979–1981), *Mork & Mindy* (1978–1982), and *Battlestar Galactica* (1978–1979), among others. The same thing was happening on the big screen where theatergoers were being treated to major releases featuring the kinds of themes players would soon find in *Tempest* and other arcade games: space battles (*Star Trek: The Motion Picture*), alien invasion (*Alien*; *Phantasm*), a near-future apocalypse (*Mad Max*; *Meteor*; *The China Syndrome*; *Prophecy*), time travel (*The Black Hole*; *Time After Time*), and the Cold War (*Moonraker*; *Apocalypse Now*). In fact, by the end of 1980, many of the futuristic concepts of the late 1970s had become reality.

Technological innovations and the convergences they encouraged extended well beyond the mass media. GPS technology, for instance, which had proven indispensable for military applications, would soon be made available to the public, changing how people thought about navigation in everything from life-critical (e.g., commercial airline flights) to life-enhancing (e.g., returning to a favorite fishing spot) undertakings. Similarly, new techniques had been developed for data transmission over Ethernet, allowing for (at the time) extremely high-speed transmissions (10 Mbs or about 1.2 MB/second). At the same time, Bill Gates's new company

Micro-soft—this was the original spelling—was hired by IBM to write an operating system for its soon-to-be-released personal computer; Raymond Damadian released the first commercial full body MRI scanner; and the lithium-ion battery—today a mainstay of the modern consumer electronics industry—was made practical. More than ever, people in industrialized nations were experiencing the ways in which computers could do more than just compute; they could save lives, expand the horizons of the species, and, of course, entertain.

The possibilities of computers and other new technologies could also frighten. Throughout 1980, the Unabomber's anti-technology attacks continued unabated and filmmakers seemed obsessed with stories of advanced alien invaders (*Gamera: Super Monster*; *Flash Gordon*; *Superman II*), repressive technological societies (*Star Wars Episode V: The Empire Strikes Back*; *Battle Beyond the Stars*), new and old technologies in conflict (*The Final Countdown*; *Galaxina*; *Altered States*; *Saturn 3*), and the absurd, sometimes tragic effects that technologically entwined life begets (*Hangar 18*; *The Ninth Configuration*; *The Shining*; *Cheech & Chong's Next Movie*; *Caddyshack*).⁶ These same themes pervaded television as well, echoing in ongoing programming and new fare alike, ranging from the sublime (*Cosmos: A Personal Voyage*) to the ridiculous (*Beyond Westworld*; *Galactica 1980*).

Particularly noteworthy in 1981 was IBM's announcement of the IBM PC. The machine was relatively unremarkable from aesthetic, performance, and price-point perspectives: it looked like a bland office machine, used a tried-and-true processor (i.e., slow even by 1981 standards) and an inefficient operating system (*Micro-soft DOS 1.0*), and cost around \$1,600 (a sizeable amount then). By comparison, the Commodore VIC-20 was much cheaper (\$300), the Apple II better looking, the Osborne 1 more portable, and the TI-99/4A produced better graphics. What the IBM PC had, however, was an open architecture (i.e., anyone could develop hardware and software for it) and IBM's marketing muscle and brand recognition to foster rapid market penetration. By the time *Tempest* was hitting its stride in arcades, 1.4 million personal computers had become fixtures in homes and businesses, double the number of the year before (Reimer 2005).

Needless to say, the media industries both encouraged and benefited from this popularization of computation. In 1981, MTV, HBO, and Showtime joined CNN and Cinemax in offering twenty-four-hours-a-day programming, a development made possible in part by advances in both industrial and consumer-level computing and electronics (including satellite

deployment and video recording devices). Concomitantly, all manner of shows on television (e.g., *Hill Street Blues*, *The Fall Guy*, *Falcon Crest*) featured episodes that hinged on computer culture, from hacking, bank fraud, and disastrously buggy software, to love scenes, shoot-outs, and nerd duels in video game arcades.

Filmmakers, too, had discovered the power and appeal of computers, using them behind, if not necessarily on, the screen. *Raiders of the Lost Ark*, for instance, thrilled fans with its spectacular and computer-assisted special effects. While the effects themselves were optical and not digital in nature, computers were essential to their production. It was computers that precisely controlled the cameras that moved among the film's life-like miniature sets, providing exceptionally smooth shots that would have been impossible otherwise (Robertson 2008).

Computers were on the screen too—or at least appeared to be. *Escape from New York*, for example, contains images of a vector-based computer navigation panel. These images were not produced by computer, however, but with three dimensional models painted black and outlined with reflective tape. In a bit of moviemaking magic, the models were filmed under black light, causing the tape to light up in full color and produce the illusion of vector graphics (Squires 2011). Other films relied on similar tricks to mimic this kind of computational visualization, from *Outland*, which used several varieties of vector-like imagery to depict computer interfaces and space effects (including one that looks strikingly like *Tempest's* cylinder tube), to the disturbing poster art of British cult classic *Inseminoid*.

In fact, the vector graphics aesthetic—sharp lines, saturated colors, and often a sense of three-dimensionality—seems to represent for the late 1970s and early 1980s popular imagination the enormous stored up energy of computers and offered waypoints for highly industrialized society that lead from the urban dirt and grime of the present to the pristine flux and fluidity of the future. The malevolent sorcerer (appropriately named “Evil”) from *Time Bandits* sums up this vision well (if tongue-in-cheek) when he muses on the motives behind his latest plan to his lackey, Robert:

EVIL: When I have the map, I will be free, and the world will be different, because I have understanding.

ROBERT: Uh, understanding of what, Master?

EVIL: Digital watches. And soon I shall have understanding of video cassette recorders and car telephones. And when I have understanding

of them, I shall have understanding of computers. And when I have understanding of computers, I shall be the Supreme Being!

In 1982, a year after *Tempest's* release, the planets aligned in ways that confirmed the game's high-tech iconic arcade experience⁷: compact discs became available to the general public; Disney's futuristic EPCOT Center opened; emoticons and computer viri entered the mainstream; Dolby Surround Sound was offered in home audio components; British commercial network Television South broadcast the first television program depicting three-dimensional computer graphics; and *Time* magazine famously chose "The Computer" as its 1982 Man of the Year. In addition, *T.J. Hooker* (starring *Star Trek* legend William Shatner) and *The Powers of Matthew Star* (notable here for its opening and closing segments that used the same electric blue vectors that made *Tempest* so distinctive) debuted, even as mass media executives began to actively pursue closing the format gap between video games and television (e.g., *Knight Rider* was made into a themed game and *Pac-Man* prompted a Saturday morning cartoon). By 1983, CBS had an entire television stable of video game characters grouped together under the title *Saturday Supercade*, and by 1984, ABC was airing a cartoon based on *Dragon's Lair*.

Games were being developed from other properties too. *E.T.: The Extra-Terrestrial*, *Star Trek II: The Wrath of Khan*, *Poltergeist*, *Firefox*, *First Blood*, *The Dark Crystal*, *Conan the Barbarian*, *Blade Runner*, *Megaforce*, *Porky's*, *On the Trail of the Pink Panther*, *Rocky III*, and *Tron* were all 1982 films that were soon followed by video game treatments. Interestingly, while much has been written about the US video game crash of 1983–84, comparatively little scholarship has documented the role of television and film in that phenomenon. Instead, pundits observe (quite rightly) that the crash was primarily due to poor quality control, low barriers to entry, and few video game powerhouses dominating the marketplace. Clearly, though, consumers in the late 1970s and early 1980s were being overwhelmed with the video game concept from all over the media landscape. Not only was there a glut of video games by 1983, there was also a glut of media experiences constellating around video games generally.

There are few examples of how the proliferation and penetration of computationally driven mass media was evolving that are more salient and disturbing than David Cronenberg's 1983 film *Videodrome*. Starring James Woods as Max Ren, an ambitious executive at a small television station,

the movie depicts Ren's descent into a suicidal madness catalyzed by a covert, brain-tumor inducing signal embedded in a pirated television broadcast of scenes of anonymous tortures and murders. While the movie's tag line—"First it controls your mind, then it destroys your body"—appears to refer to the medium of television, an attentive viewing suggests that Cronenberg was commenting on the whole of the early 1980s mass media apparatus—from the new 24/7/365 broadcast cycle, to the amorality of media executives, to the increasingly immersive voyeurism that newer television programming was enabling, to the full-scale integration of computers into mass media. Significantly, Cronenberg placed an Atari 800 computer system, Atari 810 floppy disk drive, two Atari 2600 joysticks, and two Atari games (*Combat* [1977] and *Air-Sea Battle* [1977]) in two decisive scenes in the film, as if to emphasize that the eros generated by the nexus of television, violence, computation, play, and the human psyche promised only the most ruinous of ends. As science-fiction scholars Sherryl Vint and Mark Bould put it:

The image of the visceral, fleshy videotape [in *Videodrome*] reveals how we are programmed by the signals we consume, and also emphasises [sic] the continuity of this realm of representation with the material, fleshy world. [. . .] The real battles are not fought on television screens, in abstract codes of information that exist in a separate space from the biological existence of human life. Rather, the representation and the material are relentlessly intertwined: technological artefacts [sic] fuse with and transform into flesh (Vint and Bould 2006, 238).

Videodrome, in other words, both enacted and depicted how synergies among real life, mass media, and entertainment could impact the human spirit in devastatingly deleterious ways.

Verisimilitude was not the only aesthetic being used at this time to convey the significance of the convergence of mass media and entertainment, however. Vector graphics, too—despite being relatively new and expensive (when actually rendered by computer, at least)—were becoming increasingly commonplace and had already been put before the public eye on television (e.g., *Buck Rogers in the 25th Century* [1979]; *Sapphire & Steel* [1979]) and film (*Star Wars* [1977]; *Alien* [1979]; *The Black Hole* [1979]) prior to *Tempest's* development. Therefore, while we cannot dispute Theurer's attribution of *Tempest's* origins to a dream, we would add that the chances of his

dream imagery having been influenced by the proliferation of *Tempest*-like imagery and content (not to mention the computers used to make them) in popular culture up to that point are high. We suggest, too, that other extant game machines of that time influentially flowed into and out from the *Tempest* of Theurer's imagination; this specific marketplace context is the subject of the next section.

Marketplace Context

The late 1970s and early 1980s were, for all intents and purposes, the golden age of the video game arcade. Within Atari's stable alone, dozens of classic titles flank *Tempest*: *Asteroids* (1979), *Monte Carlo* (1980), *Battlezone* (1980), *Centipede* (1981), *Dig Dug* (1982), and *Crystal Castles* (1983), to name just a few. Atari's primary competitor in the vector game market at the time was Cinematronics, and in a distant third place was the short-lived breakaway company Vectorbeam, started by Larry Rosenthal (developer of Cinematronics' *SpaceWar!*-inspired game *Space Wars* [1977]) and Bill Cravens. Over the course of five years (1978–1983), Cinematronics and Vectorbeam produced a number of notable vector-based games, including *Rip Off* (1980), *Armor Attack* (1980), *Star Castle* (1980), and *Cosmic Chasm* (1983). In the home market, the GCE/Milton Bradley Vectrex console—an exclusively vector graphics-based game system—weakly competed with Atari's 5200 system, both of which were released in 1982.

While the reasons behind the early popularity of vector-based games are manifold and interwoven, several technical and marketplace details are important to highlight. First and foremost, the wireframe format of vector games in this era could be rendered on screen much more rapidly than raster graphics, a fact that permitted the design of games with more fluidly animated interactive elements. Vector graphics also facilitated the construction of rudimentary but navigable three-dimensional environments, which gave consumers a taste of virtual world immersion. By the time *Tempest* was released, this latter fact had already garnered the attention of studio executives at Disney. The company had tested the vector graphics waters in 1979 with *The Black Hole* and was on track to release *Tron* (a vector-rich 1982 film that arguably cemented vector aesthetics into mass consciousness). Interestingly, *Tron*'s creators—Steven Lisberger and Donald Kushner—were turned down by Warner Bros., MGM, and Columbia Pictures before Disney picked up the project (Culhane 1982, 3). That Warner passed on the film is perhaps understandable—it was already connected to the vector

world through its 1976 purchase of Atari. Also unsurprising is MGM's refusal to option *Tron*; the studio had fallen on hard times in the early 1970s, and by 1980 had dialed back its film production activities. Columbia Pictures' coffers were similarly diminished, not so much due to years of mismanagement (the MGM story) but rather because of a series of expensive but ultimately lucrative takeovers it had affected. Thus, even though all of these companies might ideally have wished to adopt an innovative vector graphics project like *Tron*, it was Disney that backed the venture.

It is worth dwelling for a moment on Warner Communications' connection to the vector marketplace, or rather the company's role in the media sphere of which that market was a part. The Atari acquisition enabled Warner to convert the public's growing interest in electronics and space exploration into a range of media-related consumer products to which the company already held the rights. Warner Communications, through its many subsidiaries, not only owned game software, hardware, and related patents but also some of the planet's most valuable media properties at the time. Among these properties were *Star Trek* (1966), *Mission: Impossible* (1966), and *Tarzan* (1966), all of which eventually found their way (in one form or another) into Atari's video game lineup. Warner also drew on the assets of a number of its other media content and production companies (e.g., Panavision, Elektra Records, MTV) to generate industrial and promotional leverage against its rivals.

Another important ingredient of Warner's strategy to claim its share of the growing consumer electronics market was its late 1970s development (through Warner Cable) of QUBE, the first interactive cable network and home of the Pinwheel Channel (later renamed Nickelodeon). By amassing and concentrating technologies and content providers for the purpose of capturing and acclimating consumers to the co-mingling of play, computers, and television, Warner helped redefine how everyday people approached—physically and psychologically—relatively sophisticated electronic devices. At the heart of this transformation were subsidiaries such as Atari and games such as *Tempest*, which delivered to local venues the thrill of far-off and future-found space heroes and adventures.

Returning to our discussion of *Tempest's* general marketplace context, it is instructive to look at the products that competed directly with coin-operated video games at the time. Just as the arcade industry was expanding in the late 1970s and early 1980s, so too was the home computer game industry (PCs, consoles, and handhelds). While arcade culture was already well established, with roots in the pinball and coin-operated game culture

of the 1930s (and the arcade and amusements culture before that), home video game culture was brand new. As a result, home video games had the powerful if short-lived market advantage of novelty and convenience: players could have the same kind of fun at home. Home play could also be easily supervised by parents, mitigating the manifold dangers of the local arcade (e.g., drugs, underage sexual encounters, and so forth). On the downside, home video games were often a misery to play, with poorly designed controllers, terrible graphics and sound, and even worse control schemes. They were also quite expensive to get into, both in terms of hardware and software.

Arcade machines, by contrast, offered much higher audiovisual quality, more complexity in their play offerings, and were cheaper to play (over the short term). However, arcades were often located in seedy neighborhoods and business establishments, and sustained play could wind up being surprisingly costly. It was this general dynamic—novelty, cost, quality, safety, location, and fun—that formed yet another important part of *Tempest's* context and suggests why it is helpful to understand the marketplace pressures on players when they tugged open the doors to their local arcades and ambled over to their favorite machines. Between 1979 and 1982, a decision to put more than a bit of pocket change into an arcade machine was a decision to support a particular game and its maker, as well as a decision *not* to support the growing PC gaming and home console market. It was also a decision to leave behind the steadfast but inevitably obsolete pinball machine industry.

Such choices were not always subtle or subconsciously determined: as Andy Hofle's superb "Arcade Ambience" project brilliantly illustrates, arcade goers in 1981 were routinely assailed by a cacophony of come-ons by numerous video game manufacturers, as well as by the ubiquitous corner full of warmly glowing pinball machines that chimed, thumped, and occasionally even spoke.⁸ Moreover, many of the machines in the arcade were made by the same companies that designed home console games: Atari, Data East, Bally, Sega, Gottlieb, and so on.⁹ To wade into the acoustic pandemonium of an arcade, change a sawbuck into a pocket-busting stash of tokens, and set to work on initialing a nemesis machine's high-score screen required therefore a certain level of commitment. The dedication such behaviors signify illustrates the importance for scholars of attending to games (such as *Tempest*) in their marketplace contexts: *Tempest* makes meaning through its look and feel as a game—from its soundtrack to its cabinet and marquee art (if exposed)—but also as an object (one among



Fig. 15. 1980s arcade images (Arcade images found at the “Growing Up In Arcades: 1979–1989” Flickr group and used with permission from Rich Wiebke [richie 59].)

many) of consumer choice. Even before a coin slipped its slot, *Tempest* had to attract people: gamers, of course, but before that, arcade owners, and before that, game publishers. *Tempest*, Theurer, and Atari accomplished these persuasions effectively; the game was a marketplace and critical success. To set aside the increasingly potent pressures of the emerging home gaming market and, for that matter, the important but fading star of pinball, is to ignore key industrial and consumer pressure points that had lasting consequences on *Tempest*'s value and longevity as an arcade machine and licensable property.

To conclude our discussion of the consumer-oriented elements of *Tempest*, then, we offer two simple but telling lists—located at the end of the book—that demonstrate the competitive milieu within which *Tempest* existed. Appendix A includes all the major and most of the significant minor software and hardware companies that came into being in the timeframe beginning one year before Theurer began work on *Tempest* through 1982, a year after the game's release. Anyone even marginally familiar with the video game culture of the Atari VCS era forward will, upon browsing this



Fig. 16. 1980s arcade images (Arcade images found at the “Growing Up In Arcades: 1979–1989” Flickr group and used with permission from Rich Wiebke [richie 59].)

list, likely be struck by a sense of the improbability that arcades and arcade machines could survive to the end of the millennium. While trade publications of the time (e.g., *Play Meter*) increasingly published articles tinted with low-grade panic about how to keep customers coming through arcade doors, and while pinball manufacturers shifted their design emphases from the surfer and mod themes of the 1960s and 1970s to themes drawn from the outer space and video game crazes of the 1980s,¹⁰ the home computer and home game console markets boomed (and occasionally busted) and the number of computer game software and hardware companies in North America, Europe, and Asia tripled.¹¹

Hindsight is always exceptional, of course, especially when applied to such a tumultuous period in the game industry’s history. Still, the day’s pundits were well aware of the volatility of the video game industry as a whole, in large part because they were attentive to the combination of consumer spending and business trends. As George Ditomassi, the senior



Fig. 17. 1980s arcade images (Arcade images found at the “Growing Up In Arcades: 1979–1989” Flickr group and used with permission from Rich Wiebke [richie 59].)

vice president of Milton Bradley, noted in *Business Week*: “You’ve got a bloodbath coming in cartridges” (1982). As if the home video game craze were not enough to gut the arcade industry, the home video game crash of 1983–84, which Ditomassi prophesied, certainly did the trick.

The second list, included in Appendix B, features the arcade machines released between 1979 to 1982. These were the machines that surrounded *Tempest* in busy arcades and from which *Tempest* stood out. Even a quick glance over this appendix reveals several notable data points. For starters, the number of arcade machines being produced was on the rise—from sixty-seven in 1979 to 178 by 1982—but so too were the number of game manufacturers. In 1979, approximately thirty manufacturers were making arcade machines, but by 1982 there were sixty-four—a two-fold increase. Also discernible is the spike of interest in outer space: in 1979, roughly twenty-seven of the sixty-seven games (40 percent) had a space theme, the same number—though a very different percentage (15 percent)—as

in 1982. In 1980, however, at least sixty of the approximately 128 arcade machines produced (47 percent) contained games set in outer space. The national obsession with exploration beyond Earth's atmosphere, which as we noted earlier also triggered spikes in space-themed films and television programs in 1979 and 1980, was undoubtedly precipitated by the proliferation of actual space news in the mass media: the *Voyager* missions, SkyLab, and the new Space Shuttle program had captured people's imaginations and anxieties (judging by how this theme was often treated in its various fictive forms). In any case, when *Tempest* was delivered to arcades in October of 1981, the space theme was well entrenched in players' psyches as one that was thrilling and current. Similarly, vector graphics—a technology also on the rise, as the lists show—seemed to lend a well-matched aesthetic to the jointly trending fascination and fear that accompanied its proliferation.

In addition to a fusillade of arcade machines, 1979 through 1982 also brought to consumers extensive options for home video game play. In 1979, Milton Bradley released the Microvision, the world's first mobile game system based on interchangeable cartridge technology; Texas Instruments released its TI-99/4 game-cartridge-accepting home computer; and Atari circulated advertisements for its Cosmos game system, which was to use holographic imaging technology. The Cosmos, alas, was ultimately scrapped for fear of competing with Atari's 2600 system and because "Ray Kassar [President of Atari's Consumer Division] was too scared to take a chance on the handheld/tabletop market" (Atarimuseum.com, n.d.).¹² In 1980, Nintendo released the first eight of its immensely successful Game & Watch handheld systems, Mattel marketed the much hyped Intellivision console, Sinclair Research introduced the ZX80, and Acorn Computers brought out the Atom—the latter two being home computer systems marketed for their game playing capabilities. By the time *Tempest* was in development in 1981, Astrovision had released the Bally Computer System (a rebranded version of the 1977 Bally Professional Arcade, later renamed again to the Bally Astrocade), Acorn had released its BBC Microcomputer System, Coleco had released the Total Control 4 handheld two-player game console, Commodore released the VIC-20 Personal Color Computer, Sinclair released the ZX81, and Sega began to promote its upcoming SG-1000 console. As *Tempest* ascended in popularity through 1982, Atari released the 5200 system, Coleco released both its Gemini and ColecoVision consoles, Commodore released the Commodore 64, Emerson released the Arcadia 2001 system, Entrex released the Adventure Vision machine, Sinclair re-

leased the ZX Spectrum, and General Consumer Electronics released the Vectrex, a home gaming console built around a small vector graphics monitor. All told, nearly thirty home video gaming-capable machines made it to store shelves while *Tempest* was being developed, distributed, and played.

If nothing else, the proliferation was portentous: not only did the rush of consoles signal the end of the arcade as the only game in town, it also heralded the beginning of what would become the video game crash of 1983–84.¹³ Simply put, the market was being flooded with too many options. In response, many consumers chose to spend their entertainment dollars on more conventional toys, while the income from consumers who did buy one of the available systems was spread so thinly that most of the companies either folded or were snatched up at a discount by larger companies.

That said, the flood of consoles and computers yielded a torrent of games. In 1979, the “voracious video-game market” (as one reporter would later call it) produced such legendary titles as *Akalabeth: World of Doom*, *Adventure*, and *Flight Simulator* (Polskin 1982, n.p.), and by 1980, Atari had converted the arcade hit *Space Invaders* into a 2600 cartridge, while *Rogue*, another legendary title (it occupies position #6 on *PC World’s* list of “10 Greatest PC Games Ever”) began to circulate freely among computer users around the world (Edwards 2009, n.p.). At the same time, Infocom released the first of its famous *Zork* titles, and the Apple II game *The Prisoner* (based on a popular television program) was published.

Still more notable titles arrived in 1981, as did two significant game journalism outlets: *Electronic Games* (US) and *Computer and Video Games* (UK), both subsequently recognized as founders of this area of reportage. Among the now famous games these magazines covered soon after their launch were *3D Monster Maze*, *Ultima I: The First Age of Darkness*, *Wizardry: Proving Grounds of the Mad Overlord*, *President Elect*, and *Castle Wolfenstein*. Needless to say, 1982 was just as energized, with console releases spanning the legendary (*Barnstorming*, *Megamania*, *E.T.: The Extra-Terrestrial*, *Utopia*, *Dragonstomper*, *Escape from the Mindmaster*, *Star Wars: The Empire Strikes Back*, *Prisoner 2*, *Wizardry II: The Knight of Diamonds*, *Ultima II: The Revenge of the Enchantress*) to the infamous (*Custer’s Revenge*, *Burning Desire*, and several other adult titles for the Atari 2600).

Perhaps the best popular indicators that home video games were beginning to supplant arcade games occurred in the middle and at the end of 1982. In June, *TV Guide’s* Howard Polskin published a feature article about Mattel’s video game development division (i.e., games for the Intellivision), and in December, cable station TBS rolled out *Starcade*, a game show in

which contestants played newly released arcade games for prizes and included two episodes in which a *Tempest* machine was the grand prize.¹⁴ In what was clearly a desperate attempt to reinvigorate interest in arcade machines, *Starcade* was designed to reach out to the very people who were suddenly spending more time watching—and playing on—their televisions than playing video games at the mall, bowling alley, or corner bar.

Conclusion

One last context we would like to touch on briefly en route to chapter 4 and an exploration of *Tempest*'s post-release life is the game's ludic context, or the playful environment in which it was most likely found. *Tempest* was delivered to video game arcades near their commercial and cultural zenith, at a time when these spaces were still full of people and machines. Golden era arcades were often loud (with music blared through ceiling speakers so as to be heard over the clamor of game sounds), dim (so as to better display game screens and lighted marquees), and smelly (while the olfactory characteristics of every arcade were different, they generally included a mixture of cigarettes, ozone, popcorn, carpet adhesive, and liberally applied teenage aftershave and perfume unable to quite mask the bountiful teenage B.O.). They were also performative and educational spaces: captivating games attracted players in crowds, making public performance a tangible part of the arcade experience. Commonly, younger players learned from older ones, not only play techniques but also more ritualistic behaviors such as the custom of letting quarters or tokens wait in line for a turn at the machine, queuing up coins along the screen bezel or the marquee frame of currently occupied machines. In fact, the performance/spectator dynamic became so common that by late 1981, higher end arcades began offering the option of "Auxiliary Show Monitors" (as Bally/Midway called them), view screens that sat on top of the most popular arcade machines so that as a crowd grew, people toward the back could also enjoy the action. As one Bally/Midway promotional flyer provocatively read: "Watching can almost be as much fun as playing" (Bally/Midway Manufacturing Company 1982).

To varying degrees, Dave Theurer's games enjoyed this kind of attention, drawing players and observers alike. While Theurer's first game—*Atari Soccer* (1979), an innovative four-player offering the likes of which is unusual even today—was popular due to its cooperative/competitive design, and Theurer's last game—*I, Robot* (1983), a 3-D shooter/art experiment—drew attention because of its unique look, unusual modes,

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Fig. r8. Bally/Midway auxiliary show monitor

and curious rules, it was Theurer's middle games—*Missile Command* and *Tempest*—that became arcade darlings.

With its large trackball, spare but intense sound effects, furious game play, and pointed geopolitical commentary, *Missile Command* was instantly popular and in fact stayed popular for years. The game involved protecting six cities and three anti-ballistic missile launch sites from ICBMs falling from the sky. Over the course of the game, the missiles fall faster, split

apart and become multiple warheads, and are periodically joined by an array of other flying and falling objects, from fighter planes to smart bombs to UFOs. When all six of the player's cities are destroyed, the playfield erupts with a nuclear cloud, which upon dissipation leaves only a devastated landscape and the ominous double entendre "Game Over."

Interestingly (but not surprisingly), *Tempest* and *Missile Command* have much in common. Both involve fending off waves of invaders that move along linear paths, both have enemies that fracture and multiply, and both employ unusual controls. While many of the arcade machines surrounding *Missile Command* and *Tempest*—Theurer's machines often co-existed in arcades, despite being released a year apart—used conventional buttons and eight-position joysticks, these two games used unusual physical interfaces that were also highly responsive and tactile. Additionally, neither game used music, a design choice that complemented their high-contrast playfields—bright colors against a black background. (Technically, there is one tiny piece of music in *Tempest*—assuming one does not categorize sound effects as music—but it is easily missed if one is not hyper-attentive. Upon reaching a score sufficient to be awarded a point bonus, there is a high-pitched, one-second long, arpeggio of six to eight notes that seems to be non-diegetic.)

With *Tempest*, however, Theurer moved away from the representational style of *Missile Command*, opting instead for what 3-D computer animators refer to as "primitives" (i.e., simple geometric shapes such as triangles, rectangles, and other sorts of polygons). As we detailed in chapter 1, these shapes comprise the game's playfield and the interactive objects that occupy it (i.e., the avatar and enemies), creating an abstract and distinctive experience. Thus, running across *Tempest* in an arcade could be startling. Lacking mutant animals, vengeful karatekas, and commonplace controls, *Tempest* encouraged attentiveness to the whole of a constantly and dynamically changing playfield. Its aesthetic was simple but deep, its controls unequivocal. And, unlike *Missile Command* where player guesses often pay off thanks to conjunctions of angles and the size of explosions, guesses in *Tempest* tend to destroy the shooter.

Tempest's mechanics were by no means unique, but combined with the precision lines of its vector graphics, the required mental and physical accuracy of play matched the visual precision of the game's thin lines. Other machines, too, had unforgiving play (e.g., *Frogger* [1981]), but their raster graphics often frustrated players, even those who had learned the vagaries of where the hardware perceived the back of one sprite and the front of

another. Not so with *Tempest*. When the shooter explodes into a set of concentric polygons, there is no ambiguity about how it happened: the shooter was touched—ever so slightly, but unmistakably—by an enemy. In arcades full of machines that depended on players' acceptance of the imprecision of raster graphics, *Tempest* offered a different experience, one that allowed a human to perform like a machine: perfectly. Indeed, *Tempest*'s vectors and precision control knob could enable impressive synchronization with the player's eyes and mind, and it is perhaps this experience of deep immersion combined with near absolute control that led to the mythic *Polybius* story—*Tempest* as a CIA brain-washing instrument—that we described in chapter 1. And once again, it is this tight integration among mind, body, screen, and interface that invokes the movie *Videodrome*, wherein the protagonist's body becomes one with a pistol—itsself reminiscent of a TV remote—which the protagonist ultimately uses to switch himself off.

As with any game, *Tempest*'s interactive context is diverse and expansive, and therefore inevitably and uniquely characterized by what each player brings to the game. Still, *Tempest*'s distinctive look and feel made it iconic.¹⁵ To play *Tempest* was to play with the future, to touch the virtual, to leave behind raster cartoons for the wireframe building blocks of a vicinal tomorrow. It is to this tomorrow, the afterlife of *Tempest*, that we now attend.

CHAPTER 4

Life after *Tempest*

Despite its arcade success, *Tempest* has had a humble post-release life. While system ports, clones, hacks, and sequels have appeared with surprising regularity over the past thirty years—and not infrequently with legal abandon—the game has received nowhere near the industrial or cultural recognition of *Space Invaders*, *Pac-Man*, or the like. These more famous games have inspired far more secondary material, from spin-off games to television cartoons to bed sheets and pajamas. One reason for *Tempest*'s post-paucity is Theurer's spartan design, which offers would-be adapters few visual, narrative, or gameplay hooks to draw from, and so there is not much material to build upon.

Likewise, the game's distinctive physical interface—which approximates the control of a heavy piece of machinery—is ideal for *Tempest* but virtually worthless for (the majority of) games whose control schemes are not based on circular and single plane movement. In fact, in the thirty years since *Tempest*'s release, no company has created an inexpensive, dedicated spinner for home use. A number of aftermarket spinners are available to non-commercial arcade machine builders from companies such as Ultimarc, Oscar, and Ithaca Digital Technologies. These devices, however, are not intended to be used out-of-the-box. Such controllers generally require a considerable amount of technical know-how—from basic carpentry to intermediate-level wiring, soldering, and programming—to install.

For do-it-yourselfers not quite ready to build a full-size arcade cabinet with an industrial spinner, less demanding solutions for controlling spinner-based games such as *Tempest*, *Tron*, and *Arkanoid* have been developed. “Mst3kpimp” (2011) on the *Atari Age* web forum, for example, pro-

vides detailed instructions for hacking a 2004 *Jakks Pacific Atari Paddle TV Games* (2004) toy—essentially a handheld paddle that also contains thirteen paddle-based Atari games and connects directly to a television—so that it becomes a passable USB-based *Tempest* spinner. As of the end of 2014, however, we were not able to locate any commercial product for the home market that could be easily connected to a computer or game console for use with a *Tempest* remake, port, clone, or sequel, a sign that today the game is more iconically than ludically valuable.

This is not to say that the game industry is averse to making and selling specialized ancillary controllers: the Nintendo Power Glove is certainly among the most famous of such devices, as is the *Steel Battalion* (2002) controller with its dozens of buttons and switches, left- and right-hand control sticks (used simultaneously), and small pallet of foot-pedals. From light rifles and dance pads to bongo drums and faux Stratocasters, the game industry has always recognized the marketing potential and play appeal of unconventional peripherals.¹ It may seem a bit surprising, then, that *Tempest* for the home has gone without a spinner, especially given the game's nostalgic potency. As we show in this chapter, however, *Tempest's* longevity in the marketplace is only partially related to consumers' access to an authentic arcade experience. More importantly, *Tempest's* staying power flows from the game's value as an arcade *icon*, a "classic" of the industry.

In this chapter, we consider *Tempest* post-release. We recount and analyze its emulations, ports, remakes, sequels, and clones and explore how the game became subject to a long series of corporate instabilities at Atari that, in certain respects, worked in its favor and at least partially explain why *Tempest* remained anchored to an historical moment when other popular games did not. We also examine how *Tempest's* later iterations adhered to and diverged from Theurer's original design and discuss what these changes—often involving the addition of new tubes, power-ups, multi-player modes, and graphical and audio updates—signify about evolving tastes in the video game market.

The Power of Ports and Remakes

There have been at least three dozen attempts to rejuvenate *Tempest* since the game's release in 1981. None of these has been particularly successful in any conventional sense—financial, aesthetic, pleasurable, or historical—yet each has played a part in the life of the Atari brand, beginning with the authorized versions of the game that were released on the ZX Spectrum for

the European market in 1983. The first two of these came from Germany's EMM Software, the less buggy of which was later released in Britain as *G-Force* by Euro-Byte.² These versions of *Tempest* used a top-down perspective and looked considerably more primitive than their arcade progenitor. A remake for the ZX Spectrum was also released in the United Kingdom in 1983 by Mikro-Gen. It used a side-view instead of a top-down perspective, and as a result, even though the game was called *Tempest*, it bore a stronger resemblance to Williams's 1980 arcade classic *Defender*.

Within a few years, home computer systems had begun to approximate the audiovisual quality of arcade games, and during the second half of the 1980s, several higher-end licensed home versions of *Tempest* were brought to market. The versions for the BBC Microcomputer System (1985) and its more affordable cousin the Acorn Electron (1985) were a step up from what home gamers had seen before: the perspective was correct, the vectors and tubes accurately drawn, and the sound was reasonably close. A new version for the ZX Spectrum and its rival the Amstrad Colour Personal Computer was released in 1987, controversially both distributed on the same cassette by a third-party developer, followed by a port for the Atari ST in 1989.³ Most of these ports appear to have been modestly successful and remain relatively easy to find through online auction houses, a phenomenon that suggests reasonably high unit sales originally.

Tempest also enjoyed a limited extension of its notoriety and iconicity through a variety of "arcade classics" releases, that is, ported versions of popular arcade games bundled together on one disk. In 1993, for example, *Microsoft Arcade* for both Windows 3.1 and the Apple Macintosh introduced home computer gamers to *Tempest*, *Battlezone*, *Asteroids*, *Centipede*, and *Missile Command*.⁴ Similarly, Midway's *Arcade's Greatest Hits: The Atari Collection 1* brought these five games—plus *Super Breakout* (1979)—to the Sony PlayStation, Sega Saturn, and Super Nintendo Entertainment System in 1996 and 1997. In 1999, Hasbro and Digital Eclipse released *Atari Arcade Hits: Volume 1*, which contained these six games plus *PONG*, *Asteroids Deluxe* (1981), *Crystal Castles* (1983), *Gravitar* (1982), *Millipede* (1982), and *Warlords* (1980). *Atari Arcade Hits: Volume 2* was released in 2000, and the 2001 *Atari Anniversary Edition* effectively combined all the coin-operated titles on the two *Atari Arcade Hits* volumes and made them accessible to the latest generation of consoles—Sega Dreamcast, PlayStation, PC, and (in 2002) the Nintendo Game Boy Advance.⁵ One year later, Hasbro and Digital Eclipse teamed up again to bundle *Tempest* with a much larger variety of classics—a total of twelve arcade games and sixty-two Atari 2600

titles—for its 2003 *Atari Anthology* for *Windows 98*. This disk also included a high-resolution *Tempest* desktop wallpaper theme.

By 2005, *Atari Anthology* had been released for the Microsoft Xbox and Sony PlayStation 2, and the *Retro Atari Classics* collection had been released for the Nintendo DS, thus marking *Tempest*'s migration to the sixth generation of gaming consoles. In 2007, the game was carried—in both standard and updated forms—into the seventh console generation when it appeared in the Xbox Arcade Live area of the Microsoft Xbox 360's online interface. *Tempest* also became a release title for Microsoft's 2010 classic gaming service called "Game Room," accessible through the Xbox 360, Windows PCs, and devices deploying the Windows Phone Operating System for mobile devices.

Finally, for nearly as long as the World Wide Web has existed there have been web-accessible versions of *Tempest*. These include early *Flash* and JavaScript programs as well as downloadable apps for browsers such as Google Chrome and various mobile devices. While there are too many of these web-accessible versions to list here, one representative sample is Code Mystics' *Tempest*, which can be found on dozens (if not hundreds) of websites around the world.⁶

In many respects, the history of *Tempest*'s appearance in arcade game anthologies is also the history of Atari itself, particularly after the mid-1990s.⁷ In 1996, for example, Atari was sold to JTS, and two years later a controlling share in the game maker was sold to Hasbro. This share was passed to Infogrames Entertainment in 2000 when it acquired Hasbro, and in 2008 Infogrames purchased Atari's outstanding shares and converted the company into a privately and wholly owned subsidiary. When Atari was sold to JTS, many of its valuable properties (including *Tempest*) were bundled by the new owner and pushed to market—*Arcade's Greatest Hits: The Atari Collection 1*—to remonetize Atari's catalog and perhaps offset some of the expense and debt JTS had just assumed. In 1999, not long after JTS sold Atari to Hasbro due to the game developer's continued insolvency, *Atari Arcade Hits: Volume 1* was developed and released, again presumably to ease what was now Hasbro's new debt. When Hasbro passed to Infogrames, Atari's new owner also attempted to remonetize the company's catalog, first with the 2001 and 2002 multi-platform versions of the *Atari Anniversary Edition*, then with the 2003 eighty-game collection *Atari Anthology*, and so on through the new editions for the sixth and seventh generation of consoles. As the fortunes of Atari rose and fell, among the few low-hanging fruits each of the company's new owners could pick were the iconic and thus most lucrative brands—including *Tempest*. Paradoxically, then, it was Atari's

perpetual financial jeopardy (after 1996 at least) that helped keep *Tempest* in the public eye long after it had disappeared from arcades.

Prototypes and Hacks

While *Tempest* itself endured in part as a monetizable piece of a software catalog, it also persisted in the form of “also ran” titles. These versions were, in one way or another, fueled by the original game even as they often violated its look, feel, and play qualities. For example, *Tempest* prototypes were made for the Atari 2600 and 5200. Neither prototype was ever commercially distributed on its own, though they were included—more for novelty or history’s sake than enjoyment—in several of the Atari anthologies we detailed above. Both prototypes are largely unplayable, the 2600 version because of that system’s graphical limitations and the 5200 version because it lacked collision detection.⁸

Another prototype, *Abyss*, programmed by retro-game creator John Dondzila in 1999 for the Vectrex home console, also went uncompleted and unreleased.⁹ According to Dondzila (2013), he “was unhappy with the look and feel” of his game, an assessment partly dictated no doubt by the fact that while the Vectrex was a vector-based machine, its input was stick-not spinner-based.¹⁰

Long before any of these home console prototypes existed, however, arcade machine hackers—often coin-op machine service technicians or hands-on arcade owners and managers—had developed a number of their own prototypes and hacks that were built directly over and into the original *Tempest* machine’s hardware. Duncan Brown, a co-owner of the 1980s-era Professor Fether’s Arcade in Charlottesville, Virginia, for example, reverse engineered *Tempest* in 1982 to create the now famous (within the collector community at least) *Tempest Tubes*, which added new—and more difficult—levels to the game. This hack circulated among arcade operators, though for obvious reasons without Brown’s name attached. In 1998, Hasbro/Digital Eclipse identified and tracked down Brown and, as Brown tells it, surprised him by asking—instead of pressing charges—if his hack could be included on the company’s 1999 *Atari Arcade Hits: Volume 1* disc, for which he would be paid \$1,000.¹¹ While Brown had performed a brute force hack—exposing the code byte by byte—to allow him to create new tubes, Simon Mills took a different approach. In 2000, Mills created *TempEd*, a full-featured tube editor for *Tempest* that allows anyone with the gumption to design new tubes, add them to the game, and play them in an emulator.¹²

Finally, there is Clay Cowgill’s *Tempest Multigame* (1999), a boon to the

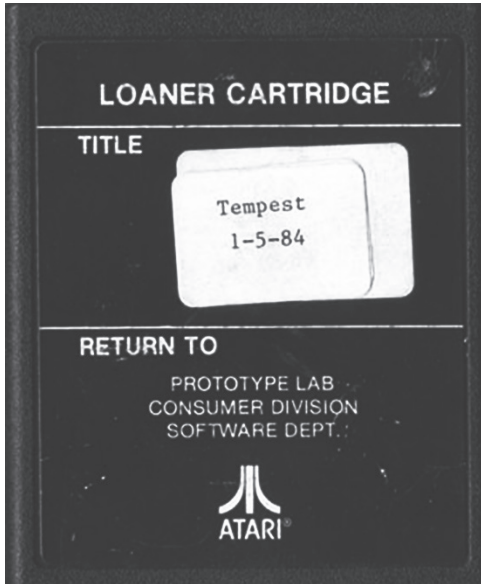


Fig. 19. Atari *Tempest* for 2600 prototype cart (Image used by kind permission of Matt Reichert, atariprotos.com.)

Tempest collector because it combines all three authorized system updates—known as “Revision 1,” “Revision 2,” and “Revision 3”—with Theurer’s two prototype designs, *Aliens!* and *Vortex*, plus Duncan Brown’s *Tempest Tubes* and two of Cowgill’s own titles, *Vector Breakout* (1999) and *Vector Breakout Plus* (1999). All nine games are selectable from *Tempest Multigame*’s start screen. Unlike the Atari arcade game anthologies we listed earlier, *Tempest Multigame* was actually a modification kit for the *Tempest* arcade machine itself. Comprised of a mezzanine board that plugged into *Tempest*’s main integrated circuit board, a Video RAM expander board, and two integrated circuit sockets, the kit allowed *Tempest* machine owners to directly deploy the full history of the game within a single cabinet—useful for collectors and archivists alike. Cowgill first offered his kit for sale on the web in 2000 for \$109.00 but soon thereafter raised the price to \$129.00, where it stayed until he stopped making it in early 2007.¹³ It is here especially, among the mundane details of making, distributing, and buying post-release *Tempest* prototypes and hacks—some legal, some not—that some of the game’s most devoted fans are most readily detectable. These are the players who loved the game so much that they wanted it to be more than it was—and made it so. With the exception of the addition of new tubes, Theurer’s original design was left more or less untouched. But as the video game market picked

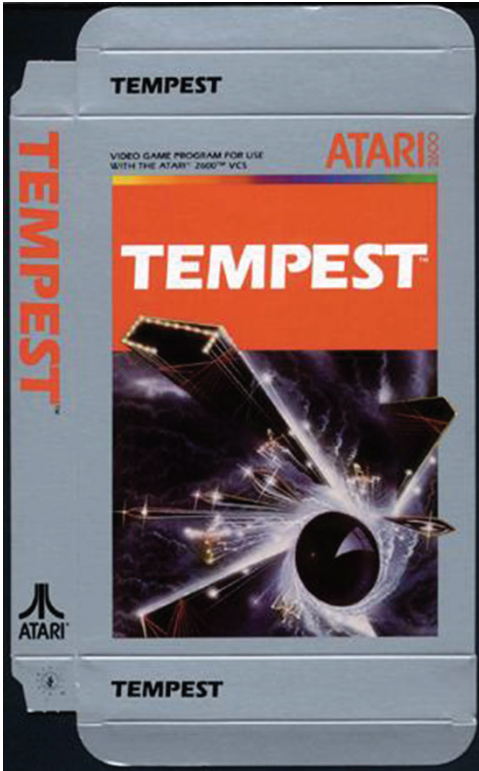


Fig. 20. Atari *Tempest* for 2600 prototype box art (Image used by kind permission of Matt Reichert, atariprotos.com.)

up after the 1983–84 crash, and as consumer tastes in video games became more sophisticated (or at least more accustomed to play-based spectacle), Atari and its various stakeholders sought new ways to convert their once prosperous properties into expandable franchises that would not only further energize the value of the original intellectual property but also grow them through licensed clones and sequels.

Clones and Sequels

Just as today, the proliferation of software duplicates in gaming's early history was rapid and frequently unauthorized. The rundown of prototypes and hacks in the previous section illustrates this in part, but another piece of the ecosystem involves more polished and, if not authorized then at least legally ambiguous, clones and sequels. A "clone" is a software imitation that is just different enough from the original to provide legal protection from

intellectual property infringement proceedings. An early example from *Tempest*'s history is GCE's *Bedlam* for the Vectrex. Released in 1982, less than a year after *Tempest*, *Bedlam* had players firing a cannon at approaching enemies inside a series of changing geometrical vector forms.¹⁴ It also had a "Zap" button that would destroy all enemies currently on the screen. Unlike *Tempest*, however, *Bedlam* places the cannon at the center of the forms, with the player seeming to look down directly from above rather than from an oblique angle. Moreover, while the player can rotate the cannon, it is fixed in the center of the screen while the geometric shape itself rotates. In this respect, *Bedlam* builds on one of Dave Theurer's early concepts for *Tempest*, that is, to have the tube rotate instead of the player's avatar.¹⁵

Although the first authorized version of *Tempest* became available for the Apple Macintosh in 1993 with the release of *Microsoft Arcade*, desirous Mac users had been playing the game—or a reasonable approximation of it—for nearly two years by then. In 1991, a freely distributed *Tempest* clone called *Arashi* (which means "storm" in Japanese) had been developed by Project STORM Team and then shared among gamers using electronic bulletin boards, university and corporate computer networks, and the so-called sneaker net (i.e., putting the game on a floppy disk and walking it over to someone else's computer).¹⁶ *Arashi* ran under Mac OS 6, and apart from its sounds and decidedly different attract mode and high-score registration screen, looked quite similar to *Tempest*.

MacAttack, another *Tempest* clone for the Mac written by Roger Kemper, was released sometime between 1993 and 1995 by New Reality Entertainment. Using fully shaded tubes (as opposed to simple wireframes) and a settings interface specifically designed for Mac users, *MacAttack* draws on the metaphor of the "Net" infected with marauding "viruses" to motivate player action. While the game is clearly derived from the *Tempest* gene pool, virtually all of its details differ from the original: the style is 3-D sprite-driven, the available playfields are all minor variations on a flat plane, the sounds are different, and there is a much greater variety of enemies—including a huge levitating AI robot at higher levels.

Although the Mac community's interest in *Tempest* seemed to be waning by the late 1990s, and Atari was in the throes of salvaging what it could of its principal properties at the turn of the millennium, retro programmers began to take up the challenge of home brewing a *Tempest* clone for the most obvious game console for such a title, the Vectrex. As we explained earlier, John Dondzila's 1999 title *Abyss* was an unfinished project for the long since abandoned vector-based system licensed and distributed by

Milton Bradley. Two years later, however, Christopher Tumber released a complete and working *Tempest* clone for the Vectrex called *Tsunami* (2001). While it lacks the color and sound of the original, and the collision detection is a bit inconsistent, *Tsunami* offers a reasonably good visual approximation of *Tempest*.

Even as these hacks and home brews were being created, a number of other small developers had obtained the rights to produce legal sequels to *Tempest*. In 1994, Jeff Minter—founder of Llamasoft—wrote *Tempest 2000*, a more stylized and acoustically rich game than the original, but one still ludically familiar. The game was developed for Atari's recently released (1993) Jaguar system, but given its initial positive reception by reviewers (and the Jaguar's less positive treatment by game industry pundits) it was soon ported to other systems, including the PC, Mac, PlayStation (enhanced and renamed *Tempest X3*), and Saturn.¹⁷ *Tempest 2000* introduces many new tube shapes, as well as numerous new play mechanics: power-ups, a variety of weapons, a jump feature that enables players to momentarily launch the shooter off the near end of the tube in order to avoid enemies that have made it that far, and an "A.I. Droid" helper that adds to the player's firepower. It also includes a game save feature allowing players to pick up where they last left off, and paradigmatic game balance and point mechanics. A critically acclaimed techno soundtrack completed the package, and the game went on to win *Electronic Gaming Monthly's* 1994 Jaguar Game of the Year award. Admittedly, the competition was hardly stiff; among the sixteen Jaguar games released in 1994 were *Evolution: Dinodudes*, *Brutal Sports Football*, and *Checkered Flag*, all of which have been heralded as among the worst games to be released for the system. In fairness, however, *DOOM* and *Wolfenstein 3D* were also released that year for the Jaguar, but the former had already been out for a year on other systems and the latter had been out for twice that long.¹⁸

The PlayStation version of *Tempest 2000*, called *Tempest X3*, deserves attention all its own. Released in 1996, a full two years after Minter's remake, *Tempest X3* is, as video game critic Stuart Campbell puts it, "almost as different from *Tempest 2000* as *Tempest 2000* was from the original *Tempest*. The core gameplay might be the same, but there are so many extras, and so many changes to existing elements, that to all intents and purposes it's a whole new sequel rather than a slight update" ("Reap the Wild Wind," n.d.). As Campbell rightly points out, *Tempest X3* is far more expansive than *Tempest 2000*, sporting numerous new tubes, hidden modes, tweaked graphics and animations, new enemies, and improved game balance. And

yet, the game received very little press, perhaps because its developer, Interplay, was better known for its *Star Trek* properties, not its action-shooters. In any case, *Tempest X3* clearly benefitted from the boost in power that the PlayStation's superior hardware lent the game, so much so in fact that the game continued to be popular on the PlayStation 2, which was backward compatible (i.e., the PlayStation 2 can play PlayStation games).

The advantages of increased hardware power are clearer still when one compares all of the titles in *Tempest 2000*'s lineage thread: 1994's *Tempest 2000*, 1996's *Tempest X3*, 2001's (oddly named) *Tempest 1000*, and 2006's *Typhoon 2001*. This latter title, coded by German programmer Thorsten Kuphaldt and released as freeware for Windows and Linux, occupies a liminal space between clone and sequel. Many of its features are duplications of Minter's *Tempest 2000*, from the shapes and distinctive movements of the tubes (called "webs" by Minter and other post-*Tempest* designers), to the types of weapons, power-ups, and on-screen action hints (e.g., "Collect Powerups!"). Indeed, so similar are these key elements that Kuphaldt commented in a 2007 interview in *RGCD* (Retro Gamer CD) that "Jeff [Minter] initially was not exactly happy about me developing the game, but his position is quite understandable if you know the back-story behind other remakes and ports of *Tempest 2000*."¹⁹ Despite its strong similarities, however, Kuphaldt's remake is quite distinctive from Minter's version released some dozen years earlier. Perhaps most striking is the smoothness of its animations and clarity of its graphics—no doubt due in part to the superior hardware that *Typhoon 2001* ran on, as well as its use of OpenGL, a high-performance application programming interface that enabled Kuphaldt's game code to utilize the power of the specialized graphics processing units contained in most mid-2000s-era Windows and Linux machines. Also notable, however, is the game's built-in level editor (briefly discussed earlier), which enables players to create and integrate new "webs" far more easily than any previous version had allowed, including *TempEd*.

It is a telling detail that Kuphaldt opted to remake Minter's 1994 *Tempest 2000* rather than Minter's 2000 *Tempest 3000*, which was technically only the third *Tempest* sequel. This latter title, to date the last Atari-licensed version of *Tempest* (not including ports of Theurer's original game for new systems, the Internet, and so forth), was developed for a consumer technology just coming to market and one that many electronics industry observers had high hopes for. NUON was a chipset, operating system, and programming platform designed by VM Labs—founded by former Atari vice president Richard Miller—in the late 1990s and released for production in

1999. It was developed with a vision that saw DVD players (within which NUON would piggyback) becoming the primary entertainment console in the home. NUON would not only enhance the playing of movies and other conventional digitally recorded content but would also make that content more interactive (e.g., smooth scanning and search features, 20x zoom) and provide a platform for high-end gaming (one early promo showed Mario's hat [of *Super Mario Bros.* fame] sitting in a puddle of blood, intimating that the system was going to finally unseat Nintendo in the video game marketplace). It would even allow for Internet browsing, e-mail, and video conferencing (Nuon.tv 1999). With *Tempest 3000*, Minter (a major contributor to the development of the NUON system) extensively updated his previous sequel, but reviews of the game were mixed. Boasting, as usual, new levels, new enemies and enemy behaviors, and impressive new sounds and graphics, *Tempest 3000* was enthusiastically admired by some gamers who were captivated by what can fairly be called the game's revelry in pandemonium: wild colors, unrelenting and unpredictable enemies, an intense soundtrack, and maddening (even taunting) sound effects. Other players found these same qualities to be infuriatingly confusing and complained that the NUON's controller and lack of a save system were retrograde, not the new apogee of home gaming (Campbell, "Blowing Hot and Cold," n.d.; Papercut 2005).

In 2003, three years after Minter's NUON sequel, a German company named Apocalypse released an unauthorized clone known as *Tsunami 2010*.²⁰ Though the game received meager attention by the media—press reviews included little more than a screenshot, and a link to the Apocalypse website appeared in *Edge Magazine* and *PC Action*—it did include a facelift, the ability to use one's own CDs as the soundtrack for play, and a few other modest changes from *Tempest 3000*. Despite *Tsunami 2010* being a competent and even enjoyable clone, however, Minter's ability to write code that can generate spectacular visuals and deploy them effectively in a game has proven tough to imitate. Indeed, a comprehensive review of all known *Tempest* clones, hacks, revisions, and sequels to date suggests that the only designer capable of outdoing Minter is Minter himself. In 2007, along with colleague Ivan Zorzin at Llamasoft (the development studio Minter started in 1982), Minter released a new *Tempest* homage, one that again exploded with color and sound.²¹ *Space Giraffe* was released in August of 2007 on Xbox Live Arcade and a year and half later (December 2008) for the PC. The game's name refers to what Minter renamed the original *Tempest* shooter after conducting an informal poll about it on a Llamasoft web

board. The game's design could arguably be called *Tempest's* apotheosis and unfailingly elicits comments from players and spectators alike who wonder what kinds of "design aids" Minter and Zorzin were ingesting when they created the game. Awash in multiple ever-shifting palettes, *Space Giraffe* has an almost unrivalled surreal quality. Not unsurprisingly, *Space Giraffe* received mixed—"polarized" would be nearer the truth—reviews, with all but the most tenacious players condemning the game for its cacophony of color, action, and animation that make gameplay exceedingly challenging (see Gerstmann 2007; Reed 2007; Gillen 2008).

The initially overwhelming feeling in this game where confusion is a primary play mechanic is often a difficult one to overcome, even for seasoned players. Yet *Tempest* produced a similar sense of confusion and anxiety in its day. That said, *Tempest* was no visual riot like *Space Giraffe*—on the contrary, its spare play field and stark vectors were monastic in comparison to many other arcade games. Arguably, after nearly three decades of naturalization to the extravagances of video game development, the prospects for evoking in players that same sense of confusion and anxiety are now narrow. It takes far more to disconcert 21st-century gamers than it did when Theurer was coding his nightmares into Atari machines. From this perspective, *Space Giraffe* is perhaps the truest *Tempest* homage to date, approximating in modern gamers the mental and haptic pandemonium that *Tempest's* very first players experienced.²²

A lacuna opens here in what might be termed *Tempest's* "afterlife." It was precisely the game's simplicity and abstraction, combined with the relentlessly industrial invasion from the bottom of the tubes, that created the ludic chaos that players loved or hated (or both) about *Tempest* in 1981. That same minimalism has also ensured that *Tempest* stays *Tempest*, which is to say that the game is so spare that it takes very few changes to its mode and presentation to make it not just another game but an entirely different genre. This, we contend, is what anchors the game so immovably to its originary moment, and also what dooms its potential to become that most valuable of commodities, the forgettable progenitor. Who thinks of *Duck Hunt* (1984) when playing *Halo 4* (2012) or *Haunted House* (1982) when playing *Resident Evil 6* (2012)? Generally, only video game archivists and historians. For game publishers, mercurial archetypes such as the first-person shooter are money in the bank because they establish a look and feel for gameplay that can take innumerable forms. Load up *Space Giraffe*, on the other hand, and anyone with even a basic familiarity with retro gaming or arcade culture will instantly identify it as a *Tempest* knockoff despite its

audiovisual squall and Llamasoft's objections to the contrary.²³ Brand solidity is brilliant to a point, but while the value of a universally recognizable brand can seem limitless, it is so only as long as consumers stay interested in it. Once the glister fades, the brand wanted by consumers everywhere becomes overnight the brand they are dead-set against. This is the *Tempest* paradox: its striking aesthetic flash-froze it into history, never forgotten but never freed.

There are a number of other games that, while they resemble *Tempest* or one of its authorized sequels, are decidedly distinct from the original. Fitting into a category generally labeled "tube shooters"—a term that originates with Theurer's progenitor of the species—these games tend to involve shooting at objects emerging from the bottom or vanishing point of a three-dimensional tube shape and moving toward the player's avatar. Examples of tube shooters include (among many others) *Buck Rogers: Planet of Zoom* (1982), *Gyruss* (1983), *S.T.U.N. Runner* (1989), *Hyper Zone* (1991), *N2O: Nitrous Oxide* (1998), *iS: internal section* (1999), *Sewer Shark* (1992), *Rez* (2002), *GyroStarr* (2008), *Child of Eden* (2011), and *Dyad* (2012). Games such as these, some released mere weeks after Atari's original *Tempest* while others are being developed even now, signify the tenacity and appeal of Theurer's concept, which no doubt has itself yet deeper origins and influences than we can trace here.

Having surveyed *Tempest*'s post-release impact within the game development world, we draw to a close this excursion into the game's afterlife with a brief look at *Tempest* beyond games. This world, which we call *Tempest-iana*, is perhaps the brightest beacon signaling *Tempest*'s enduring spark.

Tempest in a (Literal) Teapot

In the Learning Games Initiative Research Archive, there are thousands of games, hundreds of game systems and peripherals, and all manner of academic and trade books about the craft of video game design, development, and criticism. Despite this cornucopia of wonder, however, there are three display cases in particular over which the Archive's many visitors linger the longest. More or less artfully displayed in these cases is a small sampling of the Archive's collection of video game crafts and *objets d'art*: a piece of lumber with a scene from *Pac-Man* airbrushed onto its rough surface, an eerie Super Mario decoupage onto a light switch cover plate, a US quarter crushed and imprinted with the face of astronaut and legendary game and

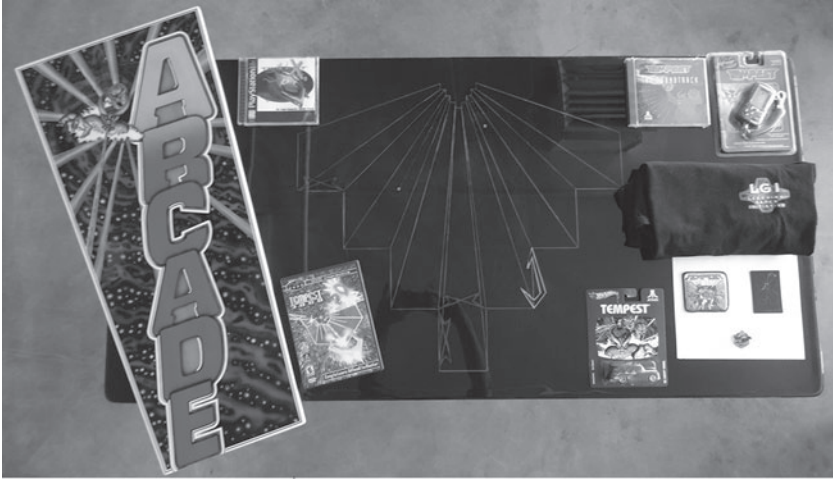


Fig. 21. Atari *Tempest* arts and crafts (Tempest © 1981 Atari Interactive. All Rights Reserved. Tempest is a trademark owned by Atari Interactive, Inc. Use of Tempest images and trademark are provided under license by Atari Interactive, Inc.)



geocache designer Richard Garriott. These are the artifacts of fandom, the markers of devotion, and the badges of commitment that lend a soul, so to speak, to the games they honor. The crocheted *Tetris* refrigerator magnets, the handmade bar of soap shaped like an NES controller, the garage-built *PONG* machine housed in an Altoids tin—handmade memorabilia such as these function as both media and receptacles, connecting one player to another through a kind of post-arcade memorial link across time and space, while simultaneously storing in the artifacts themselves the sweet nonpareil of hours spent at play.

Among the densest collections of gamic craftwork the Archive holds

is the one that constellates around *Tempest*. In fact, it was this amalgam of non-digital but digitally referential curios that prompted us to write this book in the first place. As archivists and new media scholars, we wanted to better understand what sort of game would have the power to inspire painters, tilers, woodworkers, basement hobbyists, and kitchen table crafters of all stripes to spend their time, talent, and treasure paying their respects to an arcade machine and the game it enables. From lagniappes as simple as a homemade button boasting a laminated *Tempest* screenshot, to a “*Tempest Junkie*” T-shirt, to Intrepid Otter’s hand-dyed wool yarn matched to the color of *Tempest*’s electric blue vectors, to Rosemarie Fiore’s photographic artwork “*Long Exposures of Video War Games*” that includes a spectacular rendering of a complete game of *Tempest* in a single image, each of these tributes recollects and shares forward an experience of engagement, luck, skill, frustration, patience, and captured imagination. This is *Tempest*’s life after the decline and fall of the western arcade, and it is the gamer’s life, too, after the selfsame decline. Through hacks, clones, remakes, and sequels, as well as through embroidered patches and lovingly framed cabinet art, *Tempest* lives on not just in players’ memories but also in their fingertips, fashions, films, and furnishings.

And, of course, in writing and research. This book seeks to answer, in part, the question “*Why remember Tempest?*” and in chapter 5 we summarize the highlights of that answer as we have traced it over the course of the preceding chapters. However, we also mean for this book to be our own crafty approbation, more verbose (to be sure) than a *Tempest* tube-shaped ocarina but just as earnestly and delightedly done.

CHAPTER 5

Conclusion

Over the course of this book, we have explored the aesthetic, technological, and interactive elements that distinguish *Tempest* as a landmark video game. In the process, we have moved from a close, textual analysis to a broad, contextual one as a way to articulate as well as illuminate these elements. Our focus now is summative and explicative. We want to revisit our preceding analyses in order to clarify *Tempest's* overall historical and cultural significance. We also want to situate the idea of landmark games and the process of defining them in the material and intellectual history of video game studies broadly. Understanding these artifacts and their import is vital to the theoretical, practical, and praxical development of the field, especially as it continues to expand across disciplines and institutions.

Tempest Redux

One of the challenges of organizing a book so that it moves from the textual to the contextual—as we have in this volume—is that while it provides an excellent structure for developing a comprehensive view of a subject, it is less fit for offering a balanced view of the relative importance of any given detail. For this reason, we want to begin our descent into the conclusion with an expanded summary that lends some topographic relief to *Tempest's* history and context, thus clarifying how the network of meanings we have cataloged up to this point interrelate. Through such a big picture wrap-up, we mean to help readers draw their own conclusions (as well as consider ours) by delimiting in a concentrated form the peaks and valleys of our wide-ranging analysis of this landmark game. Such an alternative

approach, though brief, aims to acknowledge that the orderly prioritizations we chose for governing the majority of the book are not necessarily the best (and certainly not the only) ways to think about the subject.

We begin this overview with chapter 1, where we offered a thick description of *Tempest*, starting with the game's spare but distinctive aesthetics and proceeding through its technological and ludic innovations. Of particular pertinence was the relationship between the game's graphics and play, or rather, the ways in which Theurer's visual design seemed to experiment with the interactive and ideological possibilities of both on-screen and off-screen space. For instance, in *Tempest*, there is the essential (and at times maddening) fact that the shooter's movement is confined to the near rim of the tubes. In fact, *Tempest's* play very much hinges on this particular circumscription: the game is all about avoiding additional constraints to the shooter's movement (e.g., when Flippers reach the near end of the tube and effectively cut off the shooter's escape routes, or when Pulsars charge gutters and change the geometry of a tube).¹ And yet, depending on the tube, this movement can actually controvert the sense of constraint. Moving endlessly—and seemingly frictionlessly thanks to the game's special control system—around the rim in either direction can connote a sense of freedom, albeit a limited one (the player cannot break free from the playfield, for example, or decide to traverse its depth). It is the freedom to travel without obstruction and at virtually any speed, the freedom to inscribe the playfield according to one's sensibilities.² Indeed, it is precisely because of the limitations of the playfield—which Theurer designed to appear obvious (even undeniable) and which the shooter's movement also reinforces by reinscribing them—that the possibility of endless spin exists. More simply, *Tempest* establishes limitations on the screen and then plays with those limitations, sometimes gently (as in the case of spinning freely around the rim of a closed tube), sometimes less so (as in the case of the game's invisible levels, which make play even more difficult). It is an early moment in the commercial and technological history of video games in which a designer is both exploring and commenting on the medium's meaning-making possibilities.

Tempest was innovative in other ways too, especially in terms of how it connected play and narrativity and explored the significance of play generally. The game's Skill-Step system, for example, not only enabled players to self-select their level of expertise or desired challenge, but in so doing also nuanced and described the play experience itself. It was Skill-Step that palpably evoked and emphasized tropes of progress, mastery, and the like,

incentivizing players to take on greater challenges (and thus part with their money more quickly) but also earn greater rewards (in the form of point bonuses, the respect of spectators, and so forth). As we explained in chapter 1, “In helping narrativize *Tempest’s* play experience in this and other ways—that is, in supplying the rudiments of a story to a game that did not readily seem to have one—Skill-Step provided a way to indirectly yet concretely supplement the game as a purely playful act, i.e., to give *Tempest* a tangible and interpretable significance beyond the refulgent but largely non-cognitive pleasures of simply doing.”

In much the same fashion, but for a different audience, *Tempest’s* Operator-Information Display (OID) also narrativized play, reporting usage data of all kinds to machine owners so that they could better understand how and by whom their machines were being played. In other words, the OID told the players’ story. Play metadata of this sort has subsequently become integral to the practices of game development/management and play, assisting designers in clarifying their work and showing players how to better understand and enjoy theirs (i.e., the work of play and the pleasures of recognizing such work). As a result, today play and its study are often conjoined visibly and invisibly across the whole of the computer game complex, raising a host of important questions and opportunities for scholars, developers, and players alike.

In chapter 2, we conducted a generic analysis of *Tempest*, situating the game within but also outside of the Abstract and Shoot ‘Em Up genres that Wolf outlines in his extensive video game classification system. Specifically, we diagrammed Theurer’s creation as a generic hybrid, a game that violated as well as reinforced the stylistic and playful conventions of its day. For one thing, *Tempest* was both abstract and concrete in its visual design. The game’s spartan and geometric iconography abstracts a series of mathematical formulations—themselves abstractions of concrete space—yet ties those abstractions to a specific Greco-Roman aesthetic and ideology, that of Ptolemaic Greece and Renaissance Italy. Similarly, there is an ambiguity to the game’s interpellations, with the cabinet artwork promising one experience and the software delivering another. The sum effect of these and other juxtapositions and disconnections both in-game and out is surprising and unconventional: in contrast to many of its contemporaries, *Tempest* managed to be commercially successful without hewing to generic expectation. It did not offer more of the same, and yet was not penalized economically or critically for its divergence. On the contrary, *Tempest* was compelling in part precisely because of its hybridity. As we noted in chapter

2, it was able to venerate the Shoot 'Em up and Abstract genres “without necessarily depending on them for semiotic and narrative weight.”

Tempest's ambiguities are more than merely interesting or distinctive, however: in addition to breaking with tradition they prototyped it. *Tempest's* rudimentary multiperspectivalism, for instance—the way in which the game and its cabinet seemed to suggest both first-person and third-person perspectives simultaneously—forecast what is now commonplace in games: multivalent play. The inclusion of a multiplicity of distinctive but articulated possibility spaces within a single environment (e.g., first-person shooters featuring third-person play segments, third-person games with first-person elements, and so forth) is one of the ways in which developers have responded to growth, diversification, and technological development in the video game market. Likewise, *Tempest* helped pioneer the concept of playful authorship, that is, player contribution beyond the normal developer-player collaboration found in any game (computer-driven or otherwise). *Tempest's* Skill-Step system initiates play by asking players to make a design decision, as well as a ludic one: how difficult should the game be? Moreover, it couches this decision narratively, via numerical (level 1–11) and descriptive (“Novice” to “Expert”) scales. In so doing, *Tempest* invites players to express themselves structurally—in terms of the *ludus* and the narrative—not just playfully, to set the parameters and context of the end experience in addition to abiding by them. Playful authorship, the dialectical (not just dialogical) contribution of the player to the game, has become a signature element of the video game medium. In fact, it is hard to find a game today that does not directly summon its players as developers, even if that summoning is only to select a game's difficulty level, item load out, avatar appearance, and the like.

In chapter 3, we outlined *Tempest's* socio-cultural and economic contexts, concentrating on the years just prior to and just after the game's release. The late 1970s and early 1980s were astonishingly tumultuous, with a pandemic of armed conflicts, natural disasters, and political assassinations, not to mention the darkening shadow of the Cold War and its effects on political, economic, and military policy around the world. The period was also one of intense technological, technophilic, and technophobic development nationally and globally. Alongside revolutionary medical breakthroughs (e.g., the first artificial heart transplant) and thrilling pictures of deep space objects beamed back by galactic probes, were a spate of nuclear-related accidents (e.g., the meltdown at the Three Mile Island facility) and anti-technology protests (e.g., the Unabomber's attacks). The period was,

in many ways, an ideal incubator for a dream about—and subsequent artistic response to—terror and technology, a dream at the very heart of *Tempest's* creation story.

More tangibly, and arguably more important to *Tempest's* materiality, was the popular culture push into space-themed and computer-oriented (and enabled) consumption. The revelation of deep space and the penetration of the affordable personal computer into homes and businesses were accompanied by a concentration of space- and computer-themed movies, television, and video games. At the same time, the telecommunications and entertainment industries were cultivating and capitalizing on the hardware side of the new and now daily galactic and computational experience, deploying once futuristic technologies into the everyday of film production, cable television delivery, and information transfer. By 1981, space and computers had become ubiquitous—even if not readily apparent (e.g., the behind-the-scenes computer controls used in *Raiders of the Lost Ark*)—providing a fertile and perhaps inescapable intertext for *Tempest*.

One need only look to the flowering of vector graphics in-game and out for proof. Not only was the vector aesthetic prevalent in arcades and across a variety of game manufacturers and genres but in theaters, television, and at home (e.g., the Vectrex) as well. Vectors were everywhere, and as we concluded in chapter 3, seemed “to represent for the late 1970s and early 1980s popular imagination the enormous stored up energy of computers and offered waypoints for highly industrialized society that lead from the urban dirt and grime of the present to the pristine flux and fluidity of the future.” This is certainly the aesthetic and narrative trajectory of *Tron*, Disney's big budget, critically acclaimed, and commercially successful vector film that was developed and released during that time. Vectors were the future made visible in the present, and *Tempest* was the embodiment of that visibility.

In chapter 4, we recounted *Tempest's* industrial impact and explained the game's curious afterlife: while *Tempest* has its share of emulations, ports, remakes, sequels, and clones, it has never been able to pervade popular consciousness in quite the same way *Space Invaders*, *Pac-Man*, and other “brands” have. One reason is the game's particular combination of minimalist aesthetics and high-definition tacticity. This combination proved appealing to visual designers of other products—from movies to television ads—but made it nearly impossible to extend *Tempest* as a malleable franchise. *Tempest's* look and feel are effectively *Tempest's* alone; there is little room for significant transformation and extension the way Atari's *PONG* became Nintendo's *Super Tennis* (1991), which became Electronic Arts'

Grand Slam Tennis 2 (2012). Instead, *Tempest*'s many imitations and few sequels are instantly recognizable as having emerged from the original's stock. Even Jeff Minter's seemingly LSD-inspired sequels bear an unmistakable likeness to their forbearer more than thirty years and many computational revolutions later. *Tempest* was, in other words, distinctive enough to become iconic yet too distinctive to become an endlessly renewable commodity. *Tempest* is the video game industry's haute couture, influential in its angles, textures, and layers, but far too conceptual to be imported in toto into everyday use.

Another reason for *Tempest*'s petrified celebrity flows from the travails of its parent company, Atari. Over the course of its history, Atari has gone from boom to bust many times, narrowly escaping extinction thanks to its sustained brand recognition and stable of iconic (if often stale) games. Each time Atari was sold off, its new owners produced yet another re-release of the company's arcade classics. Such "new" products, which ranged from simple ports for the latest generation of home consoles to complete remakes loaded with complementary and supplementary content, worked to constantly revivify the Atari brand and literally bank on the nostalgia that *Tempest* and other games could elicit. From this perspective, the worst decision a new owner of Atari could make would be to update or transform *Tempest*; the game's commodity power was (and remains) anchored to the early 1980s and all that era signifies. To update *Tempest* is to uproot *Tempest*, robbing it of much of what makes it valuable as an icon—its context.

Of course, the game's signifying power has produced all manner of *Tempest*-iana. Beyond the games *Tempest* inspired are the deeper fan creations, the (often) handmade *objets* that honor the game on a more personal level. From one-off tee shirts to art photos to pipe-cleaner sculptures, fans have exceeded the flattery of imitation and extended the soul of Theurer's creation many times into the real world through their handiwork. We would argue, in fact, that the game's truest liberty, its freedom from its own past, is found here. *Tempest* itself may be fixed in time, but its ongoing cultural impact is best observed, as we note at the end of chapter 4, in the lovingly homemade memorabilia that "recollects and shares forward an experience of engagement, luck, skill, frustration, patience, and captured imagination." This, we propose, is among *Tempest*'s most animated legacies.

Looking back over these and the other observations we have made in this book, it is easy to see why *Tempest* was a landmark video game. It was distinctive in its look, sound, and feel upon release, predictive in its vision

of play and player, and commercially and culturally memorable despite a modest performance in the marketplace over the long term. Moreover, it embodied in such a pellucid and uncompromised way the centrality of play to game design—not just to its end product—and the ways this play flows to and through the game and its players. As a result, and like all of the games in the Landmark Video Games series, *Tempest* is an historical and cultural cairn, an index to the aesthetic, technological, and ludic geographies and geologies of the video game medium as they have evolved over time.

But *Tempest* is also something more, or rather, the Landmark Video Games series of which *Tempest* is a part is significant beyond the specific histories its games index. As helpful as canon formation can be to the theoretical and applied trajectory of a field—and the Landmark Video Games series is in part intended to do this sort of work—there is a pressing and material reason to designate and define games as landmarks: preservation. Simply but paradoxically put, in a sense the video game medium is disappearing even as games and players proliferate. We explicate the nature and implications of this paradox in the following section, and in the process conclude our study of *Tempest* as a landmark video game.

The Landmark Game and the Recorporealization of the Medium

As software, as bits of electricity flowing to and from computer componentry many times a second, video games are evanescent. They are always and only of a moment, and in fact can only ever be something other than unactivated instructions or unrealized electrical arrays because of the hardware that enables and processes their commands.

As hardware, by contrast, games endure. They are tangible in their media (e.g., cartridges, disks, hard drives), material in their interfaces (e.g., consoles, controllers, cabinets), and concrete in the spaces they occupy (e.g., living room, arcade, archive). Games as hardware are the objects of experience, the means of interacting with the playful possibilities games as software promise. To study and preserve games, then, is to study and preserve this materiality, always and initially.

Yet video game materiality is changing. Game media are starting to disappear, or at least exist differently. The expansion of networked connectivity and the realization of quick and reliable electronic content delivery and payment have made producing cartridges, disks, packaging materials,

and even gold masters cost prohibitive. In fact, rather than develop a title to sit on store shelves, it is now often more profitable and secure not to “make” a game—that is, to eschew production of a physical copy and its associated materials (i.e., packaging, instruction booklet, lagniappes, and so forth) in favor of an electronically produced and distributed one. Similarly, game interfaces are being transformed by the emergence of affordable and accurate sensor arrays such as the Microsoft Kinect and PlayStation Eye, which turn the human body itself into a game controller. The haptic intimacy between player, controller, and software—an inveterate staple of the video game medium—is being supplanted by a gestural relationship, one in which contact is secondary and game hardware is principally and overtly surveillant rather than assistive.

As scholars, we find these developments intriguing but not astounding (not yet, anyway). They are simply further proof of the medium’s persistent dynamism, and that video games will always be remarkable to those who study them. As archivists, however, we are more watchful: indeed, these changes have our full attention. As games become differently mediated—in the sense that their individual storage containers, packaging, and dedicated controllers are discontinued—game archiving (i.e., collecting and preserving games as material artifacts) will start to narrow. Soon there will be no more new games to collect—at least not physically and in the traditional sense—and then game archives as material warehouses will only be able to traffic in the distant past, in a time when games could be held as well as played.

Computer game archives will endure, of course, in new forms, perhaps through holographic storage arrays capable of holding pristine digital copies of games themselves as well as all of the attendant development materials—concept art, design documents, licensing agreements, and so on—that provide the invaluable background so important to game scholarship.³ But this is speculation. Sadly, and already, the distant past of computer games is eroding much faster than present-day archivists can preserve it. Game media and their hardware have long ceased to be made of strong stuff. In fact, for manufacturers to do so—for them to use quality and durable materials to produce products that are long-lasting, resistant to obsolescence, and easily repairable the way arcade game manufacturers such as Atari used to do with machines like *Tempest*—would be ludicrous. The industry and its public are accustomed to—and in fact depend on—regular and even tectonic technological, aesthetic, and ludic shifts in game hardware, software, play styles, and mechanics. To produce anything other

than that which is almost instantly replaceable by something newer would be to contravene an economic, cultural, and ludic model many decades in the making, and the bedrock upon which both the game industry and its study are built.

Obviously, the simultaneous transformation of games' future and erosion of their past makes the medium's materiality and the sense-making associated with it more tenuous. At the same time, it also makes less fungible materials—such as historical materialist scholarship—more concrete and important. Essentially, the evolving state of the video game medium—the general changing of its materiality—promises to transmute writings about game history, making them into archival objects as well as analytical ones. That is, projects such as the Landmark Video Games series will invariably take on a significance beyond that of just documentation and analysis. By preserving a disappearing materiality—or at least access to the temporality of that materiality—such projects will become primary sources for scholarly work on games. They will not only point to notable aesthetic, technological, and cultural moments in game history but in fact embody them. In other words, game work will become the stuff of game studies when games themselves—or at least games as expressly material and individual objects—have disappeared.

It is with that fast approaching ekphrastic moment and the responsibility concomitant with it in mind that we conclude this book. We hope that in illuminating *Tempest's* intriguing and interwoven geometries of play—even as the game itself has dimmed with the passage of time—our modest work will contribute in some small way to the preservation and persistence of game materiality, and, perhaps even more importantly, to future scholarship and understanding of that materiality.

Appendixes

APPENDIX A

Relevant Software and Hardware Companies Created between 1979 and 1982

1979

- Software
 - Activision
 - Edu-Ware Services
 - GST Computer Systems
 - Infocom
 - Sierra On-line
 - SOFEL
 - Strategic Simulations
 - Sullivan Bluth Studios
- Hardware
 - Saitek
 - Seagate

1980

- Software
 - ADK
 - Beagle Bros. Software
 - Beam Software/Krome Studios Melbourne
 - Brøderbund Software
 - Bug-Byte
 - Culture Brain
 - Datasoft
 - FASA Corporation
 - HAL Laboratory

- The Learning Company
- Mark Williams Company
- Spectral Associates
- Hardware
 - Elsa Technology
 - United Microelectronics Corporation

1981

- Software
 - Blitz Game Studios
 - Free Fall Associates
 - Games by Apollo
 - General Computer Corporation
 - Imagic
 - J.K. Greye Software
 - Kesmai
 - Level 9 Computing
 - Nihon Falcom
 - Optimized Systems Software
- Hardware
 - Cirrus Logic
 - Creative Technology
 - Kaypro
 - Kensington Computer Products
 - Labtec
 - Logitech

1982

- Software
 - Acornsoft
 - Addictive Games
 - Alligata Software
 - Argonaut Games
 - Artech Digital Entertainment
 - Autodesk
 - Eastgate Systems
 - Electronic Arts

- English Software
- Enix
- Fox Interactive
- FTL Games
- Greve Graphics
- HummingBirdSoft
- Imagine Software
- Interactive Picture Systems
- Lucasfilm Games (became LucasArts)
- Manley & Associates
- Micro Cabin
- Micronet
- MicroProse
- New Generation Software
- Quarterdeck Office Systems
- Riverhillsoft
- SPARKLE Computer
- Superior Software
- Technology & Entertainment Software
- Thinking Rabbit
- Ultimate Play the Game (became Rare)
- UltraCade Technologies
- US Games
- Visco Corporation
- Xtalsoft
- Zenobi
- Hardware
 - Advanced Gravis Computer Technology
 - Amiga Corporation
 - Compaq Computers
 - Dragon Data
 - Happy Computers
 - NABU Network
 - Orchid Technology

Arcade Machines Released between 1979 and 1982

This list is primarily drawn (with permission) from the International Arcade Museum's Killer List of Videogames (<http://www.arcade-museum.com>), arguably the most extensive database of coin-operated machines available (though it is neither complete nor without error). We have attempted to corroborate its integrity wherever possible. Pinball machines are not included in this list for the sake of brevity; to have added them would have greatly increased the list's length. We have, however, included bowling, shuffle alley, punching bag, arm wrestling, and other such games, as there were only a few released during the late 1970s and early 1980s. Data for this table was organized by the people at the Killer List of Videogames website (KLOV.com) and the International Arcade Museum (<http://www.arcade-museum.com>), and is used with the kind permission of Greg McLemore.

We have also included non-US versions of games (e.g., Namco's *Dig Dug* was distributed in Japan under the Namco brand and under the Atari brand in the United States) when possible because such machines were known to circulate among US arcades.

Perceptive readers may discover upon further research that some of the release dates we provide do not match the ones in the Killer List of Videogames database. This is usually because that database often lists the copyright date of machines, which is frequently taken from a game's attract mode screen or from a pre-order advertising circular. While these dates are authoritative in their way, they are commonly not release dates—the focus of this list.

Also, where and when we found them, we corrected errors that are in common circulation about certain arcade machines, for example, the error that identifies many Data East games as having been published by “Nihon Bussan/AV Japan.” (In fact, the reverse seems to have been true: Nihon Bussan developed games for Data East and its DECO System.) Finally, when a machine had multiple release dates due to staggered production schedules—often the case when, for instance, a game shipped in several different form factors (e.g., upright, cabaret, cocktail, cockpit, etc.)—we used the earliest release date.

Games’ publishers are listed in parentheses. Vector-based games are boldfaced.

1979

- Alien Invader (Universal)
- Aristocrat Shuffle Alley (Williams Electronics/United)
- **Asteroids (Atari)**
- Astro Battle (Sidam)
- Astro Wars (Zaccaria)
- Atari Baseball (Atari)
- Atari Basketball (Atari)
- Atari Soccer (Atari)
- Ball Park (Taito)
- Ball Park II (Taito)
- Bomb Bee (Namco)
- Capsule Invader (Irem)
- Clay Champ (Allied Leisure Industries)
- Cosmic Guerilla (Universal)
- Cosmic Monsters (Universal)
- Crash (Exidy)
- Cutie Q (Namco)
- Deep Scan (Sega/Gremlin)
- Double Block T₃ (Sega)
- Dynamite Joe (Model Racing)
- 18 Wheeler (Midway)
- Field Goal (Taito)
- Fire One! (Exidy)
- Fortress (Sega/Gremlin)
- 4 Player Bowling Alley (Midway)
- Galaxia (Zaccaria)
- Galaxian (Namco)
- Galaxy Rescue (Taito)
- Galaxy Wars (Taito)
- GT Roadster (Ramtek)
- Head On (Sega/Gremlin)
- Head On 2 (Sega/Gremlin)
- **Hyperspace (Rumiano)**
- Invader Wars (World Vending)
- Invader’s Revenge (Zenitone Microtech)
- Invasion (Sidam)
- Invincio! (Sega/Gremlin)
- IPM Invader (IPM)
- Kamikaze (Leijac)
- King Tut Shuffle Alley (Williams Electronics/United)
- Kreepy Krawlers (Exidy)

- **Lunar Lander (Atari)**
- Lunar Rescue (Taito)
- Ozma Wars (SNK)
- Phantom II (Midway)
- Puck Man (Namco)
- Rip Cord (Exidy)
- Rolling Crash (Nichibutsu)
- Safari Rally (SNK)
- Shuttle Invader (Omori Electronics)
- Side Trak (Exidy)
- Space Attack (Sega)
- Space Fighter (Sega)
- Space Launcher (Nintendo)
- Space Phantoms (Zilec)
- Space War (Leijac/Konami)
- Star Fire (Exidy)
- Straight Flush (Taito)
- Submarine (Midway)
- **Sundance (Cinematronics)**
- Super Speed Race (Midway)
- **Tail Gunner (Cinematronics)**
- Taurus Shuffle Alley (Williams Electronics/United)
- **Warrior (Cinematronics/Vectorbeam)**
- Yosaku To Donebei (Wing)
- Zero Time (Petaco S.A.)
- ZunZun Block (Taito)

1980

- Alien Attackers (Tele Tronic)
- AME Rug (Shoei)
- **Armor Attack (Cinematronics)**
- **Asterock (Sidam)**
- Astro Fighter (Sega/Gremlin/Data East)
- Astro Invader (Stern Electronics)
- Astro Zone (Taito)
- Balloon Bomber (Taito)
- Bandido (Exidy)
- **Battlezone (Atari)**
- Berzerk (Stern Electronics)
- Black Hole (Game-A-Tron)
- Bonus Black Jack (Myimpa)
- Bust My Balloons (Status)
- Carnival (UPL)
- Cheeky Mouse (Universal)
- Cosmic Alien (Universal)
- Crazy Balloon (Taito)
- Crazy Climber (Taito)
- Crock-Man (Rene Pierre)
- Defender (Williams Electronics)
- Devil Zone (Universal)
- Diamond Poker Double-Up (Bonanza Enterprises)
- Digger (Sega/Gremlin)
- Eagle (Centuri)
- El Dorado (Grayhound)
- El Grande (Century)
- The End (Stern Electronics)
- Extra Bases (Midway)
- Final Ranger (Hoei)
- Fire Bird (Rene Pierre)
- Full Court Frenzy (Zamperla)
- Future Flash (Hoei)
- Gin Rummy (Kareteco)
- Gingateikoku No Gyakushuu (Irem)

- Golden Cup (Venture Line)
- Golden Invaders (Sigma Entertainment)
- Hana Kochou (Dynax)
- Hana no Mai (Dynax)
- Heiankyou Alien (Denki Onyko)
- Heli Fire (Nintendo)
- Hi-Lo Double Up Joker Poker (Kramer)
- Indian Battle (Taito)
- Intruder (Game Plan)
- Joker Poker 54 (Drew Industries)
- Jokers Wild (Meyco Games)
- Kaitei Takara Sagashi (Namco)
- Keno (Video Horizons)
- Keno Superstar (Merit Industries)
- Killer Comet (Centuri)
- King Pin (Games of Tomorrow)
- K.O. PunchBall (Zamperla)
- Lupin III (Taito)
- Mad Alien (Data East)
- Magical Spot (Universal)
- Magical Spot II (Universal)
- Megatack (Game Plan)
- Mini Golf (Digital Games Incorporated)
- Missile Command (Atari)
- Monaco GP (Gremlin/Sega)
- Monte Carlo (Atari)
- Moon Alien Part II (Nichibutsu)
- Moon Alpha (Nichibutsu)
- Moon Cresta (Gremlin/Sega)
- Moon Lander (Taito)
- Moon Quasar (Nichibutsu)
- Moon Raker (Nichibutsu)
- Mr. Muscle (Zamperla)
- Navarone (Namco)
- Nebula (Data East)
- New York! New York! (Gottlieb)
- No Man's Land (Universal)
- N-Sub (Sega)
- Pac-Man (Midway)
- Phoenix (Centuri)
- Polaris (Taito)
- Pro Monaco GP (Gremlin/Sega)
- Quasar (Zaccaria)
- Radar Scope (Nintendo)
- Rally-X (Midway)
- **Red Baron (Atari)**
- **Rip Off (Cinematronics)**
- Safari Rally (Taito)
- Samurai (Sega)
- Sasuke vs. Commander (SNK)
- Sheriff (Nintendo)
- Sky Chuter (Irem)
- SOS (Namco)
- Space Attack II (Zenitone-Microsec)
- Space Beam (Nanao)
- Space Bird (Hoei)
- Space Chaser (Taito)
- Space Cyclone (Taito)
- Space Demon (Fortrek)
- Space Encounters (Midway)
- Space Fever (Nintendo)
- Space Fighter Mark II (Data East)
- Space Firebird (Nintendo)

- Space Force (Venture Line)
- Space Intruder (Shoei)
- Space Invaders Deluxe (Midway)
- Space Invaders II (Midway)
- Space Invaders Part II (Taito)
- Space Laser (Taito)
- Space Panic (Universal)
- **Space Pirate (Zaccaria)**
- Space Tactics (Gremlin/Sega)
- Space Trek (Sega)
- Space Zap (Midway)
- Spectar (Exidy)
- Speed Race GP-5 (Taito)
- **Star Castle (Cinematronics)**
- Star Fighter (Ace Vending)
- Star Invaders (Potomac Mortgage Company)
- Stratovox (Taito)
- Super Earth Invasion (Competitive Video)
- Super Speed Race GP-V (Taito)
- **Tail Gunner 2 (Exidy II)**
- Tank Battalion (Namco)
- Targ (Exidy)
- Terranean (Data East)
- Tomahawk Missile (Electro Sport)
- Tomahawk 777 (Data East)
- Tora Tora (Game Plan)
- Tranquilizer Gun (Sega)
- UniWar S (Irem)
- Warlords (Atari/Warner Communications)
- Zap (Allied Leisure Industries)

1981

- Ab\$cam (US Billiards)
- Alien War (Eastern Micro Electronics)
- Alpine Ski (Taito)
- Amidar (Stern Electronics)
- Armored Car (Stern Electronics)
- **Asteroids Deluxe (Atari)**
- Astro Blaster (Sega)
- Astro Fantasia (Data East)
- Barracuda (Coinex)
- Batting Chance (Namco)
- Battle of Atlantis (Comsoft)
- Borderline (Sega)
- Bosconian (Midway)
- Bosconian (Namco)
- **Boxing Bugs (Cinematronics)**
- Cat'n Mouse (Zaccaria)
- Centipede (Warner Communications)
- Challenger (Centuri)
- Clay Champ (Namco)
- Colony 7 (Taito)
- Cosmic Avenger (Universal)
- Cosmikaze (Game-A-Tron)
- Cosmos (Century Electronics)
- Crazy Kong (Falcon/Zaccaria)
- Crush Roller (Kural Samno)
- Dambusters (South West Research)

- Daredevil (Model Racing)
- Dark Warrior (Century Electronics)
- D-Day (Olympia)
- Defense Command (Artic International)
- Donkey Kong (Nintendo)
- Double Up (Omega Products)
- Draco (Cidelsa)
- 800 Fathoms (US Billiards)
- **Eliminator (Sega/Gremlin)**
- Enigma II (Taiyo System)
- Face Up 2 I (Game-A-Tron)
- Fantasy (SNK)
- Fitter (Taito)
- 4 Fun In One System (Armenia)
- Frisky Tom (Nichibutsu)
- Frog & Spiders (Taito)
- Frogger (Sega/Gremlin)
- Funky Fish (Sun Electronics)
- Galaga (Midway)
- Galaga (Namco)
- Gorf (Midway)
- Got-Ya (Game-A-Tron)
- Grand Champion (Taito)
- Hangly Man (Nittoh)
- Hold & Draw (Amstar Electronics)
- Joker Poker 2 I (Entertainment Enterprises)
- Jump Bug (Rock-Ola)
- Jungler (Konami)
- Kaos (Game Plan)
- Kick (Midway)
- Kick-Man (Midway)
- King and Balloon (Game Plan)
- K.O. Punch (Sega)
- Lady Bug (Universal)
- Laser Base (Amstar Electronics)
- Lazarian (Bally/Midway)
- Lil' Hustler (Dynamo)
- Lock 'N Chase (Data East)
- Lock 'N Chase (Taito)
- Lucky Poker (Data East)
- Make Trax (Williams Electronics)
- Manhattan (Data East)
- Marine Date (Taito)
- Mariner (Amenip)
- Mars (Arctic Electronics)
- Mayday (Hoei)
- Mirage (Jeutel)
- Monkey Donkey (Unknown)
- Moon Shuttle (Nichibutsu)
- Moon War (Stern Electronics)
- Mouse Trap (Exidy)
- Ms. Pac-Man (Bally/Midway)
- Ms. Pac-Man (Namco)
- New Rally-X (Namco)
- Ninja (Data East)
- **Omega Race (Bally/Midway)**
- The Percussor (Orca)
- Pitch In (Namco)
- Pleiades (Centuri)
- Pulsar (Sega/Gremlin)
- Qix (Taito)
- Quarter Horse (Electro Sport)
- Rambler (G.G.I)

- Red Alert (Irem)
- River Patrol (Kersten)
- Rock Climber (Taito)
- Round-Up (Centuri)
- Route 16 (Centuri)
- Satan of Saturn (SNK)
- Scramble (Stern Electronics)
- Shark Attack (Pacific Novelty)
- 600 (Konami)
- Sky Skipper (Nintendo)
- Snap Jack (Universal)
- Solar Fox (Bally Midway)
- **Solar Quest (Cinematronics)**
- Space Dungeon (Taito)
- Space Fortress (Century Electronics)
- **Space Fury (Sega/Gremlin)**
- Space Odyssey (Sega/Gremlin)
- Space Seeker (Taito)
- Spiders (Sigma Entertainment)
- Star Raker (Sega/Gremlin)
- Star Warrior (Potomac Mortgage Company)
- Stargate (Williams Electronics)
- Strategy X (Stern Electronics)
- Super Cobra (Konami)
- Super Cobra (Stern Electronics)
- Super Heli (Unknown)
- Super Missile Attack (General Computer Corporation)
- Super Tank (Computran)
- T.T. Mahjong (Taito)
- Tactician (Konami)
- Tank Battalion (Game Plan)
- Tempest (Atari)
- Thief (Pacific Novelty)
- Tornado (Data East)
- Tri-Pool (Noma)
- Turbo (Sega)
- Turpin (Sega)
- Turtles (Stern Electronics)
- Vanguard (Centuri)
- Vanguard (SNK)
- Vanguard (Zaccaria)
- Venture (Exidy)
- Video Hustler (Konami)
- Video Hustler (Tago Electronics)
- War of the Bugs (Food and Fun/Armenia)
- Warp & Warp (Namco)
- Warp & Warp (Rock-Ola)
- Wizard of Wor (Midway)
- Zarzon (Taito)
- Zero Hour (Universal)

1982

- The Adventures of Robby Roto (Bally/Midway)
- Ali Baba and 40 Thieves (Sega)
- Angler Dangler (Data East)
- Anteater (Tago Electronics)
- Azurian Attack (Rait Electronics)

- Bagman (Valadon Automation)
- Battle Cross (Sigma Entertainment)
- Beezer (Tong)
- Birdie King (Taito)
- **Black Widow (Atari)**
- Blue Print (Bally/Midway)
- Bounty (Orca)
- Bubbles (Williams Electronics)
- Buck Rogers: Planet of Zoom (Sega)
- Bump 'n' Jump (Bally/Midway)
- Bump 'n' Jump (Data East)
- BurgerTime (Bally/Midway)
- BurgerTime (Data East)
- Burnin' Rubber (Data East)
- Catapult (Photar)
- Changes (Orca)
- Check Man (Zilec-Zenitone)
- Constella (Nichibutsu)
- Crazy Kong Jr. (Falcon)
- Cute-See (Update Kits)
- Dark Planet (Stern Electronics)
- Dazzler (Century Electronics)
- **Demon (Rock-Ola)**
- Desert Race (Moppet Video)
- Devil Fish (Artic Electronics)
- Dig Dug (Atari)
- Dig Dug (Namco)
- Disco No. 1 (Data East)
- Donkey Kong Jr. (Nintendo)
- Donkey Kong Junior (Nintendo)
- Dorodon (UPL)
- Draw Poker (Amstar Electronics)
- Dream Shopper (Sanritsu)
- The Electric Yo-Yo (Taito)
- Explorer (Data East)
- Eyes (Rock-Ola)
- Fast Freddie (Atari)
- Fishing (Data East)
- Fly-Boy (Kaneko)
- Freeze (Cinematronics)
- Frenzy (Stern Electronics)
- Front Line (Taito)
- Funky Bee (Orca)
- Gold Bug (Century Electronics)
- **Gravitar (Atari)**
- Guttang Gottong (Sega)
- Hard Hat (Exidy)
- Holey Moley (Tai)
- Hopper (Karateco)
- Hot Shocker (E.G. Felaco)
- Insector (Gottlieb)
- Jack The Giantkiller (Cinematronics)
- Jan-jan (Dynax)
- Joust (Williams Electronics)
- Jungle Boy (Taito)
- Jungle Hunt (Taito)
- Jungle King (Taito)
- Kangaroo (Sun Electronics)
- Knock Out!! (KKK)
- Kozmik Krooz'r (Bally/Midway)
- Kram (Taito)
- Lasso (SNK)
- Le Bagnard (Valadon Automation)
- Leprechaun (Moppet Video)

- Liberator (Atari)
- Loco-Motion (Centuri/
Konami)
- Logger (Century Electronics)
- Looper (Orca)
- Looping (Venture Line)
- Macho Mouse (Techstar)
- Mai Jan (Dynax)
- Marine Boy (Orca)
- Megadon (Photar)
- Mermaid (Rock-Ola)
- Mighty Monkey (Yih Lung)
- Millipede (Atari)
- Minky Monkey (Technos)
- Mission-X (Data East)
- Moguchan (Orca)
- Mole Attack (Yachiyo Electronics)
- Monster Bash (Sega)
- Moon Patrol (Irem)
- Mr. Do! (Taito)
- Mr. Do! (Yukidaruma)
- Mr. F. Lea (Pacific Novelty)
- Mrs. Dynamite (Universal)
- NATO Defense (Pacific Novelty)
- Naughty Boy (Jaleco)
- Noah's Ark (Moppet Video)
- Open Mahjong (Dynax)
- Orbitron (Signatron USA)
- Out Line (Century Electronics)
- Pac-Man Plus (Bally/Midway)
- Pac-Man Plus (Namco)
- Pengo (Sega)
- Pepper II (Exidy)
- Pioneer Balloon (Rock-Ola)
- Pirate Pete (Taito)
- Pirate Treasure (Moppet Video)
- Pisces (Subelectro)
- The Pit (Centuri)
- Pole Position (Namco/Atari)
- Ponpoko (Venture Line)
- Pooyan (Stern Electronics)
- Pop Flamer (Jaleco)
- Popeye (Nintendo)
- Port Man (Nova Games)
- Pot of Gold (Taiyo System)
- Q*bert (Gottlieb)
- **QB-3 (Rock-Ola)**
- Qix II: Tournament (Taito)
- **Quantum (Atari/Warner Communications)**
- Radical Radial (Nichibutsu)
- Reactor (Gottlieb)
- Red Clash (Kaneko)
- Rescue (Stern Electronics)
- Robotron: 2084 (Williams Electronics)
- Satan's Hollow (Bally/Midway)
- Scorpion (Zaccaria)
- SEL Jan (Dynax)
- Sinistar (Williams Electronics)
- Sky Army (Shoei)
- Sky Bumper (Venture Line)
- Slalom (Orca)
- Slither (GDI)
- **Space Duel (Atari)**
- Space Fighter X (Nichibutsu)
- Springer (Orca)
- Star Attack (Nichibutsu)
- **Star Trek: Strategic Operations Simulator (Sega)**

- Streaking (Shoei)
- Strike Bowling (Taito)
- SubRoc-3D (Sega)
- Super Astro Fighter (Data East)
- Super Bond (Alpha)
- Super Casino (Data Amusement)
- Super Locomotive (Sega)
- Super Mouse (Taito)
- Super Pac-Man (Bally/Midway)
- Super Pac-Man (Namco)
- Super Zaxxon (Sega)
- Survival (Rock-Ola)
- Swimmer (Centuri)
- **Tac/Scan (Sega)**
- Tazz Mania (Stern Electronics)
- Time Pilot (Centuri)
- Time Pilot (Konami)
- Time Tunnel (Taito)
- Treasure Hunt (Hara Industries)
- Triple Punch (KKI)
- Triv-Quiz (Status)
- Tron (Bally/Midway)
- Tug Boat (Moppet Video)
- Tunnel Hunt (Centuri)
- Tutankham (Konami)
- Tutankham (Stern Electronics)
- 21 Blackjack (Amstar Electronics)
- **Vectrex Mini-Cade (ESI)**
- Victory (Exidy)
- Video 8 Ball (Century Electronics)
- **War of the Worlds (Cinematronics)**
- Wild Western (Taito)
- Wiping (Nichibutsu)
- Word Zapper (Unknown)
- Xevious (Atari)
- Xevious (Namco)
- Zaxxon (Sega)
- **Zektor (Sega)**
- 005 (Sega)
- Zoar (Data East)
- Zoo Keeper (Taito)
- Zzyzyxx (Cinematronics)

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, Nicholls 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 pre-release—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.freemove.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 Kupholdt'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” (Yamato 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.

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