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Research Article

Mazes, monsters and multicursality. Mastering Pac-Man 1980–2016

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Abstract

This paper explores the creation and codification of techniques for playing, beating and breaking Namco's Pac-Man (1980). The findings are based on original archival research that draws on a range of early video game strategy publications in addition to more recent technical investigations of the game's code. With titles such as "How to Beat the Video Games", these mass-produced pulpy, paperbacks were concerned with revealing successful gameplay strategies for popular arcade games of the period. Providing a close reading of "Mastering Pac-Man" guide, this article explores the book's distinctive construction of the game comparing it with more recent investigations of Pac-Man's code. The article analyses the influence of the arcade context in which Pac-Man was accessed and performed and considers how an (imperfect) knowledge of the game's structure and systemic operation gave rise to a particular understanding of its ludic potential.

Pac-Man video game strategy guide walkthrough arcade coin-op gameplay

View correction statement:

Corrigendum

Public Interest Statement

Released in 1980, Pac-Man went on to become the most commercially successful arcade video game. After 30 years of consistent popularity and availability, we might think that the game has given up all of its secrets. However, despite its age, it has not been subjected to sustained critical study. This article begins by exploring the independent strategy guides published in the 1980s which sought to help players master the game. These books construct a particular “version” of Pac-Man which centres on its mazes and the memorisation of predefined routes through the game’s space. The article contrasts these approaches with contemporary analyses that try to understand the game’s operation. Making use of tools unavailable in the 1980s, today Pac-Man is analysed by investigating the game’s code. The article explores how different historical, cultural and technological contexts affect and change our appreciation of even the most seemingly well-known video games.

1. Introduction: How to beat the video games

The initial inspiration for this article came when a former research student gifted me a copy of (the revised edition of) Ken Uston’s Mastering Pac-Man. Published in early 1982, two years after the release of the game to which its title and contents refer, this 157-page paperback is a guide to playing Namco/Midway’s Pac-Man.

> How can Pac-Man conquer his enemies and earn big scores for you, his human ally? All it takes is a little practice and the help of game pro Ken Uston’s expert guide that tells you everything you need to know to become a true Pac-Master.
> (Uston, 1982: Outside back cover)

At the time I received the gift, I could by no means describe myself as an expert and was far from a “Pac-Master” (and, today, the sophistication of the analyses I have encountered in my research only serve to make me more aware of this status). However, I had played the game many times in arcades and in various other contexts as it was converted to home computers and consoles from the 1980s onwards. I had also used Pac-Man as a case study in my research and teaching to illustrate a wide range of points about video game design, paratextuality and the economies of merchandising and licensing, and we will see some of these areas explored below. Indeed, since Pac-Man’s original release in 1980, it has been subjected to a great many popular and scholarly readings drawing on wildly diverse perspectives. Many of these, as (Mateas, 2003) and Jones (2008) have noted, seek to move beyond the manifest to reveal the game’s latent meanings by making allegorical connections between Pac-Man’s insatiable hunger and constant movement and Marxist readings of consumption practices and market expansion (as in Weiss, 2003 novel Lucky Wander Boy, for instance); or between the presentation of Pac-Man’s mazes and the hyper modern “sheen of the homogenous spaces of shopping centres and the late 20th century consumer society where the aim is to consume irrespective of financial cost.” (Wade, 2014, p. 3); or regressive infantile orality and the maximisation of personal gain where dots-eat dots just as dogs-eat-dogs (Berger, 2012, p. 150). In commenting on 1990s rave culture in the UK, comedian Marcus Brigstocke joked that “If Pac-Man had affected us as kids, we’d all be running around in a darkened room munching pills and listening to repetitive music.” (Brigstocke, 2012). The routine is in part a satire on the putative effects of video game play but simultaneously reflects upon, and provides evidence for, the extent of Pac-Man’s cultural penetration and continued referential currency decades after its release.

Even given the range of analyses and commentaries to which Pac-Man has been subjected, the research and analysis in Uston’s volume came to me as something of a surprise. Its pages describe a game—or at least to construct a game through the evocation and codification of specific ways of conceiving, approaching and playing—that is quite unlike that described in more contemporary (scholarly) analyses and with which I was altogether more familiar. Investigations undertaken in recent years such as those by Pittman (2009), Hodges (2007–2015) and Mateas (2003) focus their attentions on the different behaviours and AI of the four monsters in Pac-Man[1]. According to the approaches espoused in recent Pac-Man scholarship and fan research, in order to fully

the readable movements and responses of the monsters and that bestow upon each a different “personality” as expressed through their distinctive approaches to pathfinding. Uston’s analysis, however, is one concerned with the consumption of space and the navigation of the maze. Over 120 of its approximately 150 pages are dedicated to explaining and illustrating “patterns”. These patterns are predetermined routes through each of the mazes offered up in Pac-Man (and many of its derivatives and implementations in specific arcade contexts which are profoundly affected by the settings of dip switches that govern the game’s speed, for instance). In Uston’s book, there is no mention of AI, and scarcely any of monsters, save for information on their names, discussions of their point-value when eaten and a recognition of their different tendencies in pathfinding. Rather, by overlaying carefully mapped and notated singular routes to be tirelessly followed without deviation or hesitation, “Mastering Pac-Man” transforms the multicursality of the maze into the processional unicursality of the labyrinth.

The construction of these two markedly distinct “versions” or perhaps “visions” of Pac-Man that place centre stage different aspects of the game’s system and that foreground different styles of gameplay is the starting point for the analysis here. However, my interest in Uston’s work is altogether broader.

First, “Mastering Pac-Man” is one of a number of paperback volumes published in the 1980s which is dedicated to “winning at” or “beating” video games (e.g. Kubey’s (1982) “The Winners’ Book of Video Games”; Ray Giguette’s (1981) and George Sullivan’s (1982) identically titled “How to Win at Video Games”; Michael Blanchet’s (1982) “How to Beat the Video Games” on general arcade gaming; and John D. Mulliken’s (1982) “Pac-Man: The Ultimate Key to Winning”; The Editors of Consumer Guide’s (1982a) “How to Win at Pac-Man”; and Zavisca and Beltowski (1982) “Break A Million at Pac-Man,” exploring Pac-Man in particular). The flurry of books published in the early 1980s constitute a vibrant, if short-lived, moment in video games publishing and paratextuality, and, I argue, represent some of the richest sources of documentation available that explicate video games as-they-were-played (Newman, 2016). As such, and following Wade (2014), scrutiny of these volumes is essential in providing a critical, historical basis for video game studies. Moreover, while books like Uston’s are the products of commercial publishing and superficially bear resemblance to the glossy strategy guides we see published by Prima and Brady Games today, an exploration of authorial independence and the production and research techniques utilised in these

from Uston et al's work to the player-produced walkthroughs and FAQs we see circulating online at repositories such as GameFAQs (gamefaqs.com), for instance (see Newman, 2008).

Second, and as I have suggested above, Uston's book, like a number of others published in the early 1980s, offers a particular construction of Pac-Man and its gameplay based around patterns, memorisation and the repetitious traversal of the maze. Although this might seem surprising to those more well-versed in the kinds of AI-based analyses prevalent in game studies and gamer culture post-2000, Uston's version of Pac-Man is wholly consistent with that presented in other books published at the time. By offering a close reading of these texts, with a particular focus on Uston's, I argue that this conceptualisation of the game and approach to gameplay arises for a number of reasons including: the context of the game in the arcade rather than the home; the (un)availability of tools for analysis; and an imperfect knowledge of the game's variations, structure and finality.

1.1. Pac-Man, transmediality and popular culture

While a complete history of Pac-Man and its transmedial textuality is beyond the scope of this article, some contextualisation is essential in establishing the significance of the game, both in relation to video game play and design and as a cultural phenomenon with mass-market appeal in the 1980s through to the present day.

First released under the all-too-easily-vandalised name Puck-Man in Japan in 1980 (see Kogler, 2010), the game that would become Pac-Man was created by Toru Iwatani. The design was, in part, a reaction to the plethora of shooting games that dominated the arcade space at that time. As Iwatani recalls,

> All the computer games available at the time were of the violent type–war games and space invader types. There were no games that everyone could enjoy, and especially none for women. I wanted to come up with a "comical" game women could enjoy.
> (Lammers, 1986)

Indeed, as Mateas (2003) observes, the centrality of eating in Pac-Man may be read as a literal inversion of the shooting mechanic. Much has been written about the inspiration for the character with Iwatani claiming at various points to have been

has passed into gaming folklore, other interviews have revealed a rather more complex relationship between the character's name and visual design which relate, respectively, to the onomatopoeic sound of the mouth moving in quick succession ("paku paku") and a (rounded) version of "kuchi," the Japanese character for mouth (Lammers, 1986). Borrowing from Popeye the ability to become more powerful by eating (MoMA, 2013) and taking further inspiration from the shape of a hockey puck, the character was rounded out yet further (Kent, 2001, p. 142). Bereft of even an eye, let alone arms or legs, Pac-Man may be iconic, but the character is exceptionally economical comprising nothing more than the mouth required to consume all before it. Yet, despite this simplicity, or perhaps because of it, the character of Pac-Man has remained extremely widely identifiable (Choquet, 2002). Nearly three decades after its original release, 94% of Americans were able to recognise Pac-Man giving it greater brand visibility even than Super Mario (Davie Brown Celebrity Index, 2008). Importantly, from the moment of its initial release, both the game and character enjoyed appeal across a wide demographic as had been Iwatani's intention.

> It seems that everyone, young and old alike, has fallen in love with this cute little creature who has an insatiable appetite for everything from cherries to keys and many a Blue Gremlin in between. For some people, Pac-Man is as challenging as chess, for others its as rigorous as football. One thing is for certain; it sure is a lot of fun!
> (Mulliken, 1982, p. 3)

Iwatani's reversal of the dominant tropes of contemporary video game play is clearly observable in the almost pathetic way Pac-Man implodes accompanied by a synthetic emulation of the muted trumpet wail that signals a losing answer in a quiz show.

Despite not being an immediate hit in Japan, as Loguidice and Barton (2009) observe, the game flourished upon its release in the US and before long "Pac-Man Fever" was in full flow. "Soon, every pizza parlour, supermarket, and drug store in the US had to have one. It was all Midway [the game's US importers] could do to keep up with the demand for the quarter-munching machines" (Loguidice & Barton, 2009, p. 181). By 1981, in the US, there were "approximately 250 million games of Pac-Man were being played on 100,000 Pac-Man machines in arcades every week" (Burnham, 2003, p. 234). According to Wolf (2008), the game is one of the highest grossing titles of all time, taking more than a billion dollars in the arcade alone. Of course, the arcade game is just part of the

developed sequels (Ms. Pac-Man, Super Pac-Man and Baby Pac-Man, for example), computer and console conversions and a plethora of altogether unofficial bootlegs and derivatives seeking to capitalise on the original's popularity. Most recently, in 2015, the Namco Bandai-published Pac-Man 256 (co-developed by Hipster Whale and 3 Sockets) combined elements of Crossy Road with Pac-Man's maze, monsters, fruit and pellets. The "256" of the title refers to Pac-Man's killscreen glitch which is explicitly and reflexively referenced in Pac-Man 256's graphics and design as well as in its playfully and paradoxically "endless" structure.

Although commentaries such as Burnham's are not uncommon in heaping praise on Pac-Man as "the most important game of the twentieth century," it is important to note that not all of the conversions and ports were so well-received. Indeed, as Melissinos and O'Rourke (2012) suggest, the Atari VCS port is held to be a major contributing factor in the collapse of the US market in the mid-1980s (see also Guins, 2014; Stanton, 2015). Rather more positively, and beyond the obvious inspiration for what Burnham and others dismissively term "knock-offs" such as K.C. Munchkin, Hanglyman and Mazeman, Pac-Man's influence on game design is keenly felt across the years. Curran (2004) traces the game's distinctive focus on largely nonaggressive gameplay and limited power-ups to a game as seemingly unrelated as Konami's Metal Gear Solid. For their part, Loguidice and Barton (2009) identify Pac-Man's intermission animations (known in the game as "coffee breaks" Bandai, 2010) as ur-cutscenes, thereby linking the yellow disc to the spectacular audiovisual presentation of Final Fantasy VII et al., although Pac-Man's interstitials are considerably shorter and suffused with a characteristic humour that sees Pac-Man bulking up to giant proportions, and monsters snagging their robes and revealing their hitherto unseen legs and embarrassment.

Perhaps Pac-Man's most important contribution, however, is found not in its influence on other games but rather in the way it affected popular perceptions of video gaming within popular culture. In a visual realm dominated by spaceships, Pac-Man appeared as the first recognisable, identifiable character and would soon become a de facto mascot for video games in general. For Melissinos and O'Rourke (2012, p. 22), "Pac-Man was a force of creativity" giving rise to an extraordinary array of merchandise that extended the brand across a bewildering number of media including plush toys, drinking glasses, animated TV series and even a Gold Disc-winning single penned by Jerry Buckner and Gary Garcia. As we can see in the plethora of ephemera listed in Palicia's (2002) "Pac-Man Collectibles," throughout the early 1980s, "Pac-Man Fever"

Sefton-Green (2003) later noted of Pokemon, Pac-Man was not merely something one played, but something one did. Leafing through the “Pac-Man Products” section of Consumer Guide’s “Pac-Mania” book (Editors of Consumer Guide, 1982b), it becomes clear that with pyjamas, sleeping bags, toothbrushes, hats, ties, mugs, bumper stickers, beach towels, curtains, paperweights and stickers, barely a moment needed pass or a quotidian function be performed without Pac-Man close at hand.

In a world of anonymous spaceships that Pac-Man was an identifiable character was key to its spreadability across so many mediums and sites for consumption. Moreover, the almost spartan, if appealingly charming, nature of the game’s sound and imagery coupled with the absence of a clear contextualising narrative frame lends Pac-Man an iconicity and adaptability that surely helped its transmedial extension and permeation of popular culture. However, we should be careful not to extend the view of Pac-Man’s simplicity to its gameplay. In keeping with a trend towards accessibility that is partly a consequence of the regimes of the coin-operated machine and the received wisdom that Nolan Bushnell/Nutting Associates’ failure to commercialise Computer Space had been due to the complexity of its controls (Pescovitz, 1999), Pac-Man does seem a straightforward proposition. As developer/publisher Namco (now Namco Bandai) note,

> The player controls PAC-MAN while attempting to eat all the dots in the maze and avoid getting caught by the ghosts through an extremely simple user interface consisting only of a single joystick.
> (Bandai, 2010)

However, the game’s accessibility and economy of interface belie a complexity of gameplay opportunities that lurk beneath the colourful, inviting surface. Or rather, as Wade neatly puts it,

> Pac-Man is a simple game to learn but difficult to master. This is a significant predicate of other tactically pure games such as chess, boxing and Tetris (1985) where the rules are straightforward and all of the requisite information about the game’s status is available to the player at any given point in time.
> (Wade, 2014, p. 3)

Pac-Man’s clarity of objective, deep gameplay and what might initially appear to be the inscrutability of its monster AI routines do, indeed, contrive to create a game of considerable difficulty. Moreover, while the maze does not conceal any part of its

render the game extremely susceptible to—and perhaps even demanding of—the development of tactics and strategies in place of haphazard, ad hoc play. As such, it is surprising to find no officially sanctioned player's guide among the roster of licensed merchandise and ephemera (especially given how seemingly comprehensive the catalogue was). It is into this void that Uston's "Mastering Pac-Man" is published along with its promise of high scores and winning patterns.

1.2. Of monsters and mazes

As we have intimated already, Uston's particular focus in "Mastering Pac-Man" centres on the maze or, more precisely, on defining and explicating safe pathways that consume every dot in order to lead the player to the next maze. Given that it is this construction of the game as one involving memorisation and procession that was so initially jarring upon reading Uston's book, some consideration of Pac-Man's gameplay is warranted.

Although there is no doubt that the maze is an important feature of Pac-Man providing a literal frame for the gameworld, defining routes and pathways as well as providing fertile ground for metaphorical readings of containment and inescapability as we have seen above, it is clear that the core challenge to the player comes from the monsters. Where the maze is constant and consistent across the entire game and its extent is manifest at all times, the monsters seem, at first blush at least, to be unpredictable. Importantly, the maze has a duality in being the route out of and into danger, the monsters are singularly focused on Pac-Man's demise. Of course, the monsters and maze interact, but while it is possible to conceive of an, albeit different, challenge designed without the presence of the maze, removing the monsters utterly anaesthetises any possibility of gameplay. Interviewed by Lammers (1986), Iwatani concurs.

> Well, there's not much entertainment in a game of eating, so we decided to create enemies to inject a little excitement and tension. The player had to fight the enemies to get the food. And each of the enemies has its own character. … To give the game some tension, I wanted the monsters to surround Pac Man at some stage of the game. But I felt it would be too stressful for a human being like Pac Man to be continually surrounded and hunted down. So I created the monsters' invasions to come in waves. They'd

> attack and then they'd retreat. As time went by they would regroup, attack, and disperse again. It seemed more natural than having constant attack.
> (Lammers, 1986)

In fact, and in keeping with Pac-Man's overarching theme of inversion that sees eating replace shooting as its fundamental premise, there is potential for further reversal as Pac-Man can render vulnerable the monsters and gain yet more points as the tables are turned and they are consumed.

> IWATANI: Then there was the design of the spirit (kokoro), or the energy forces of Pac Man. If you've played the game, you know that Pac Man had some ammunition of his own. If he eats an energizer at one of the four corners of the screen, he can retaliate by eating the enemy. This gives Pac Man the opportunity to be the hunter as well as the hunted.
> (Lammers, 1986)

And so whether it is because they add the "excitement and tension" that make Pac-Man a game with challenge, because the choreography of their behaviours variously coordinates and differentiates them, or because they can transform from enemy to prize, we might reasonably assume that the monsters are absolutely central to any game design or gameplay analysis of Pac-Man. Concurring, Mateas has noted that,

> The behavior of the ghosts is critical to understanding the game. The ghosts in fact define the primary action of the game. Without the ghosts there is no challenge in clearing a maze of pellets, and hence no game. … The fact that there are these multiple readings of the ghosts' behavior in fact speaks to the success of the AI design. The relatively simple algorithms of the ghost AI yields a richness and unpredictability of behavior that supports multiple interpretations, giving the ghosts an "inner life".
> (Mateas, 2003, p. 5/6)

It is for these reasons that contemporary analyses such as Mateas' as well as those offered in the encyclopaedic investigations presented by Hodges (2007–2015) and in Pittman's (2009) "Pac-Man Dossier" dedicate so much time and expend so much labour dissecting the AI and behaviours of the monsters. By working with disassembled code and analysing data flows and the systemic operation of the program's routines, these analyses seek to lay bare the most fundamental facets of design and implementation.

comprehensively lifted the lid on the operation of the AI routines. Here, however, we must turn our attentions to consider why it is that Uston focuses his research—and steers readers and players—in such a notably different direction.

1.3. Mastering Pac-Man

On the front cover of “Mastering Pac-Man,” immediately underneath the title, five lines of bold, bright red text loudly inform the reader of the book’s contents.

> Patterns, tips and strategies for doubling, tripling, and even quadrupling your score in the game that’s sweeping the country!
> (Uston, 1982: Front cover)

In addition to the front-and-centre placement of the all-important patterns, the promissory reference to increasing scores is especially telling. Thirty years after its initial release, Pac-Man has continued the transmedial journey it began in 1980, spreading across almost every conceivable gaming platform from consoles to computers, dedicated devices to handhelds and from tablets to mobile phones. More than this, the (illegal) availability of game’s program data in the form of a ROM file has an almost incalculably transformative effect. The game may be run under emulation, thereby allowing players/researchers to take advantage of the affordances of playback tools such as “savestates” or “rack advances,” for instance (to save the game at any point or to skip through levels without the need for completion). In addition to playing the game in new ways and with new technical and experiential capabilities, the availability of the Pac-Man ROM facilitates new forms of investigation rendering the game altogether more malleable. The availability and disassembly of the code allow its innermost operation and structures to be interrogated by hand and with automated analysis tools.

At the time of its release, however, it is essential to remember that Pac-Man was available to play only in the context of the arcade where its code remained securely burned onto chips soldered to printed circuit boards locked inside painted and decal-adorned cabinets. Of course, by the time “Mastering Pac-Man” was published, the game’s popularity was such that home computer and console conversions had appeared and, indeed, Uston makes reference to some of these in his tome. However, it is important to note that not only are these games different in terms of their design and operation, but they are all coded as being inferior to, or at best, imperfect facsimiles of,

Munchkin, derivatives that took inspiration from the original but that did not even set out to perfectly replicate it. The portrait orientation of the coin-op's display alone ensures that mazes are redesigned and we have noted above that Atari's licensed Pac-Man cartridge for the VCS was one of a number of titles whose poverty of implementation is widely considered to have harmed the entire video games industry and marketplace. As such, although it was not strictly the only place to play Pac-Man, the arcade was, without question, the only place to really play Pac-Man.

The consequences of this particular and singular point of access to the game are considerable. I argue that the conditions and context of the game's availability are greatly responsible for shaping the approach to Pac-Man that we observe in Uston's book and the others published during this period (e.g. Blanchet, 1982; Mulliken, 1982; Zavisca & Beltowski, 1982). The video game arcade makes a number of quite specific demands of the player and has an important role to play in framing gameplay in quite distinctive ways. Most obviously, the coin-op machine directly links Pac-Man's consumption with the player's expenditure: the machine is, quite literally, coin-operated and every game, every life, every mis-timed cornering manoeuvre, dents not only the ego but the wallet. Without doubt, the desire to "get more game time for your money than ever before," as Zavisca and Beltowski (1982, p. 5) put it in their Break a Million at Pac-Man volume, is a powerful motivator.

Maximising the amount of play time per coin is certainly important, but there is more to the arcade's influence on gameplay. The quest for high scores reveals a multifaceted and interrelated suite of issues concerning identity, personal and socially situated challenge, as well as questions relating to the public performance and consumption of gameplay. Reminding the reader of Pac-Man's difficulty at least in part to justify the worth of the patterns on offer, Uston paints a picture of a typical first encounter with the game.

> When the player puts his first quarter in a Pac-Man machine, he usually doesn't know what to expect… When the player is through, he has amassed a score of 600, or perhaps 1,500 if he was lucky. The game has lasted perhaps one minute, and the player's quarter is expended… The player's scores may increase, to perhaps 5,000 or so. He will note the "High Score" posted at the top of the screen and wonder how on earth any mortal could have scored 56,800, or 106,500, or even 249,300. After you finish this book (and invest a

> few quarters in a Pac-Man machine) you, too, should be able to achieve these kinds of scores.
> (Uston, 1982, pp. 9–10)

The high score at the top of the screen, then, gives a tantalising glimpse of a degree of expertise presently, or perhaps permanently, unattainable to the player. Moreover, the high score table is an immediate reminder of the presence of other players whether more or less masterful in their performances, and provides a lasting opportunity to inscribe one's own identity—or at least one's initials—into the fabric of the game itself. To enter the high score table is to leave a trace of one's own mastery and gameplay. The personal and social significance of the achievement was masterfully captured in George Costanza's wistful dismay and palpable sense of loss upon learning that the Frogger machine on which his high score still stood was going to be unplugged, thereby wiping its memory,

JERRY:

Hey, look at the high score—"G.L.C." George Louis Costanza. That's not you, is it?

GEORGE:

Yes! 860,000. I can't believe it's still standing. No one has beaten me in like 10 years.

JERRY:

I remember that night.GEORGE: The perfect combination of Mountain Dew and mozzarella… just the right amount of grease on the joystick.

> ('The Frogger', Seinfeld, Episode 174, 1998)

Although George may have indirectly attributed his performance to saturated fats and carbonated drinks, Uston is rather more methodical in his approach leaving nothing to chance. However, to ensure that the need for the advice is fully appreciated, the Introduction to "Mastering Pac-Man" offers a salient reminder as to just how complex and unforgiving the game appears to the uninitiated. Describing the first encounter, Uston explains how,

> The player grabs the red control knob (or "joystick") in from of him, frantically moving Pac-Man to the right, left, up, and down. Pac-Man starting "eating"

> noise. The ever-present monsters soon catch up with and ‘eat’ Pac-Man, who slowly folds his wings and disappears. … When the player is through, he has probably amassed a score of 600, or perhaps 1,500 if he was lucky. The game has lasted perhaps one minute, and the player’s quarter is expended.
> (Uston, 1982, pp. 9)

The caricature of the player as a floundering, helpless neophyte and the portrayal of the game as an initially baffling cacophony of light, movement and sound, clearly serve the function of reinforcing the need for Uston’s patterns. In order to make sense of the game’s demands and move beyond wondering, “how on earth any mortal could have scored 56,800, or 106,500, or even 249,300.” (Uston, 1982, p. 10), much of the discursive work of the opening sections of the book is dedicated to establishing the need for a systematic approach to play. Taking as read Uston’s expertise and the unimpeachability of the techniques to be revealed in the book, the importance of adopting such an ordered approach to play is effectively parlayed through the author’s biographical journey from interested but bemused beginner to “Pac-Master”.

> At first I played merely because I enjoyed the game. After a while, however, I became hooked when it became evident that the secret to the game was to develop pre-determined “patterns” of movement through the Pac-Man schematic. … [achieving good scores is] surprisingly easy if a methodical approach is taken. Indeed, the character that first attracted me to Pac-Man is that a predetermined plan is far more important for a high score than is a high degree of physical coordination.
> (Uston, 1982, p. 10)

It is notable that the promise of assistance in Uston’s text is simultaneously reassuring and paternalistic. Alongside some discussion of the potential pitfalls of playing on old machines with unreliable parts in need of service, the advice in “Mastering Pac-Man” even extends to addressing the machine with guidance on how to stand, how to grasp the joystick and how much to drink prior to play.

> Concentration is highly important. When playing, think only of your Pac-Man game. Be aware in advance what moves the pattern will require. Do not be distracted. Do not talk to others to check out the player next to you. … When I play an important game, I bend both my knees when playing. This seems to

> really hard to play well when drinking. Pac-Man would make an excellent coordination test for alleged drunk drivers. Some of my dreadful games have occurred after I had downed four or five martinis.
> (Uston, 1982, p. 125)

And so, although the adoption of the formalised approach to gameplay espoused throughout the book is central and outweighs the significance of dexterity and agility alone, the need for personal discipline is underscored from the outset. In fact, we find such foundational advice as to how to grasp the Pac-Man machine's singular controller in other texts of the time such as Mulliken's "Break a Million at Pac-Man" volume which implores the player. "Do not hold the joystick too tight, you will lose some control."

(Mulliken, 1982, p. 36).

Importantly, for all the apparent didacticism, the discursive positioning of the reader as novice and the author as expert tutor is not a simple matter of differentiation or aggrandisement, although in some cases, it is easy to read it as such. "Let the experts tell you how they win—and how you can, too." invites Ray Giguette's "How to Win at Video Games" (1981: iv), while Uston's volume opens with a description of the amount of playtime the author has under their belt. "I've spent many dozens of hours in front of a Pac-Man machine and played well over 1,500 games." In making its case, Mulliken's biography eschews modesty entirely.

> About the author: John D. Mulliken is twenty-three. He is a Master Pac-Man (tm) player. Every time he enters a store or arcade to play Pac-Man (tm) he exits a legend. He leaves with the reputation as the man to beat. They talk about his score and dream about beating it.
> (Mulliken, 1982: OBC)

The invocation of the authors' immersion within the game, the statement of the bewildering number of hours played and the acquisition of super-human scores, are all offered in support of the methodology deployed in these investigations. Quite simply, the way these once-players have become now-experts is through recording their copious and meticulous play. In this way, the category of strategy guide to which Uston's Mastering Pac-Man et al. belong bear more in common with the fan-produced works that today circulate on sites such as GameFAQs than the products of the mainstream publishing. These are codifications of the game as played by players rather

> I diagrammed and tested all the patterns and gleaned those that, with the minimum of effort, would permit the novice to develop into what we call a "PAC-Master," a player who can consistently score 150,000 or higher. I tested all the patterns on many machines to ensure they were universally applicable … I recorded my reactions in learning the patterns, little clues I developed to help in learning the patterns and in overcoming some of the frustrations of making errors so that I could pass this knowledge along to others. (Uston, 1982, p. 11)

The nature of the research is absolutely crucial. Where video game strategy guides today constitute an important ancillary business with publishers such as Prima and Brady Games working in collaboration with development studios to ensure that their often lavishly illustrated guides are available alongside the launch of any given title (see Newman, 2008, 2016), the publishing landscape in the 1980s was quite different. Uston's work is based on what is, in essence, trial and error. There is no privileged access to the game or inside information about its design or the operation of its code. Indeed, Uston's book just like Mulliken's, for instance, proudly declares their independence with boilerplate text conspicuously noting that the information is written without endorsement or affiliation from Midway.

The performance of authenticity through independence from publisher or developer is an important feature of these volumes. The information presented in Uston's book, like all of the Pac-Man-specific or generic video gaming titles published alongside it, is gleaned entirely from investigative play. I have noted elsewhere in relation to fan-produced walkthroughs (Newman, 2008) that the authors of these often extraordinarily detailed texts operate as "reverse engineers," working without access to official documentation of the program code and trying to understand their chosen game's operation solely through the acts of play, replay, observation and analysis.

In fact, this self-consciously investigative approach is particularly evident in the case of Pac-Man and precedes even the playing of the game itself. As Cohen (1984) has noted, in order to maximise their profits, and clearly in response to the success of the kind of methodical play prompted by Uston et al., arcade operators frequently sought ways of modifying their hardware/software. "Operators complained that the players weren't stuffing quarters into the machines fast enough, so the designer made the new units with a faster Pac-Man and altered the patterns." (Cohen, 1984, p. 79). Aware of these

distinct patterns are offered for what become known as the Fast and Slow games. In fact, although the speed of the game is increased and the ordering of the boards/mazes is altered, many, though far from all, of the patterns remain applicable across the two iterations.

> There is a direct correlation between the velocities and movements of the men in the Slow Game and the Fast Game. Thus the player may use identical patterns whether playing the Slow or the Fast Game (the one exception to this is the unique pattern required for the first board of the Slow Game). (Uston, 1982, p. 23)

What is key is that the revelation of these variations and the tactical responses to them are arrived at through play and play alone. In fact, some of Uston's contemporaries (including Zavisca & Beltowski, 1982, for instance) go as far as to treat the two game speeds as separate titles (rather than the same unit with altered dip-switch settings). Nonetheless, the method for identifying the version clearly emerges from considered observation and play and is expressed as a set of instructions that requires no access to the cabinet but rather a careful scrutiny of the game's pre-roll "attract" sequence. With reference to yet more annotated maps (or schematics as they are referred to in the book), and illustrating what Giordano has called the "extreme fragmentation" of video games as they evolve through time with modifications and updates changing their contours and parameters (see Newman, 2012; Sterling, 2011), Uston explains the method for discerning a machine's settings.

> It is possible to distinguish the Slow Game from the Fast Game by the sample pattern on the board before any quarters are inserted into the machine.
>
> > Slow Game. In the sample pattern, Pac-Man will eat three energizers in sequence, E4, E1 and E3 and end up being eaten by the light-blue monster just above E3.
> > Fast Game. Pac-Man will eat E4, E2, and finally E1, and then be eaten by the orange monster just below E3.
> > (Note: in the recently introduced "Atlantic City Chip" described in Chapter 15, Pac-Man eats no energizer in the sample pattern and is eaten by the light blue monster near E4.)
>
> (Uston, 1982, p. 24)

In my earlier investigations of walkthroughs and the other outputs of video game fan culture (Newman, 2008), I noted that although texts might be attributed to a single author, they were typically the products of a collective intelligence that brought together multiple contributors. While each might add only a small amount to the mix, the collaborative nature of their authorship was one of the facets of walkthroughs that renders them such valuable historical documents of games-in-play. Uston's volume is an interesting case in point in this regard and although he is responsible for generating a great many of the patterns as well as providing the authorial frame for the analysis offered in the book, the presence of other players and their insights is notable.

> After about a month of play, I discovered three patterns that allowed me to score as much as 182,000. But it was not until several weeks later in San Francisco that I encountered by chance a sixteen-year-old high school junior, Tomny L., who had been experimenting with a variety of advanced Pac-Man patterns. One pattern in particular, which Tommy call the "9Key" … fascinated me, because it allowed the player to move quantum leaps ahead of our earlier knowledge. This very pattern had brought Tommy to his high game of 932,000. Tommy later introduced me to a friend of his, Raymond, who had achieved a score of 1,400,000 on his first "man" before voluntarily quitting in midgame. Raymond, too, spent considerable time with me, introducing me to yet more intricacies of Pac-Man.
> (Uston, 1982, p. 10)

It is evident also that the interplay of these different players and their distinctive techniques drives forward the ongoing research and, in particular, the development of new patterns that unlock increasingly high scores both by extracting more points from each maze (by consuming more of the bonus fruit and monsters) and by accessing a greater number of mazes.

1.4. Patterns, mazes, arcades and labyrinths

As we note in Uston's discussion of the adoption and adaptation of Tommy's "9Key" and the insistence on a methodical approach, patterns are absolutely central to the 1980s Pac-Man gameplay. As I have noted above, the use of patterns fundamentally alters Pac-Man's spatiality, stripping it of its multicursality and replacing it with an unambiguous unicursality. The confusion of the multiple, twisting pathways is tamed as

complex and involves doubling back—demonstrating yet another reversal in Pac-Man's gameplay—its singularity transforms the maze into the labyrinth. In fact, the reverential tone of Uston et al's writing and the solemnity with which the descriptions of the patterns and, most crucially, the way in which their execution should be approached must surely remind us of the lengthy history and deep cultural symbolism of the ceremonial procession through the labyrinth (see Schuster & Carpenter, 1996). Of course, it is not only the space that is transformed in the use of these patterns. The apparent randomness and unpredictability of the monsters are utterly neutralised as the player is routed around them.

> An alternative strategy for Pac-Man is based on the fact that the monsters always react the same way to the Pac-Man's movements. A sophisticated manipulation of the monsters is sometimes possible which enables the Pac-Man to be where the monsters aren't.
> The following pattern, if used without hesitation, will lead the Pac-Man over the entire maze, arriving under the monster's pen in time to eat each fruit as it appears. In this strategy, the Pac-Man ignores the monsters, even after he eats an energizer.
> (Giguette, 1981, p. 10)

To be clear, the AI routines remain as effective as ever; it is simply that successful patterns such as this one ensure that the monsters never catch Pac-Man. Indeed, given the deterministic nature of the AI model, the monsters never will catch Pac-Man as long as this pattern is executed "without hesitation". The flawless execution of the patterns is utterly key and is a point made most emphatically in the guides.

1.4.1 Important

> Speed and timing cannot be overemphasized as crucial requirements for the success of these patterns. A slight delay when rounding a corner could throw off the rest of the pattern for the board. If it appears that you are having trouble while following the exact pattern, then you probably need more practice rounding corners. Cut them as sharp as you possibly can.
> Remember: Practice is the key to success.
> (Zavisca & Beltowski, 1982, p. 24)

It is interesting to note that many of the patterns have been designed with caution in

concentrate on survival rather than on taking risks in order to increase chances of a slightly higher point total at a given ‘board’ of the game.” The key to understanding the position here—particularly as laid out in a book entitled “Break a million at Pac-Man”—is that the long-term strategic goal of high score attainment likely outweighs the short-term tactical opportunity to maximise the points per board/maze. In this particular race, Pac-Man is the tortoise not the hare.

However, while a wariness and circumspection in patterns designed to maximise high scores might be understandable, we should not assume that there is no room for individual flair even in this regimented construction of Pac-Man as procession. Both Uston and Mulliken, for instance, recognise the player’s potential desire to imprint themselves on the game not only through the high score name entry—albeit in a manner that verges on condescension and that seems to subsume responsibility for any unwanted outcomes. “I am sure that an experienced player will want to improvise from time to time. Please feel free to do so.” (Mulliken, 1982, p. 4). Under the subheading “Conservative Improvisation” and with the earlier imperative to avoid distractions surely back in the reader’s mind), Uston offers the following opportunity.

> When there are only energizers surrounded by a few dots remaining on the board, I will say “improvise conservatively” in the narrative. Please, please follow this advice. When I say conservatively, I mean just eat the energizer and dots and only the blue monsters that can be eaten with total safety. Do not take any chances.
>
> As I write this, I know many of you will tend to ignore this advice. Please try to avoid the very strong temptation to “eat one more monster”’ In many cases, you will find the blue monster will revert to the original colour just as you try to eat him and you, in turn, will be eaten. This will be your primary reason for losing men once you’ve mastered the pattern. And it is frustrating, because it’s totally unnecessary. Remember, the key is to clear the board and go on to the next board. You will score far, far more points from additional boards than you will from attempting, unsafely, to eat up one or two more monsters. (Uston, 1982, pp. 32–33)

Looking beyond Uston’s work, we do see some rather less moderate forms of play that offer yet more evidence of the impact of the arcade not only as the site for accessing Pac-Man but also as a context in which gameplay is publicly performed. Craig Kubey’s

(1982) “The Winners” Book of Video Games’ outlines one particular pattern that is designed as much with the audience as the high score in mind.

> [previous page… Ed has not only invented Bazo’s Breaker. In his spare time] he has also come up with a very amusing pattern that he plays not for points but for fun and to delight his fans. Here this pattern will be called the Donut Dazzler. The Donut Dazzler frightens and amazes spectators because at three different points it has the Pac-Man chasing right on the heels of one or more Monsters, even though the Monsters are their usual, dangerous colours, rather than blue. At the dramatic climax of the pattern, the Pac-Man nearly collides with all Monsters at once, all of whom then peel off in different directions. The Donut Dazzler is the video version of the US Air Force Thunderbirds.(Kubey, 1982, p. 60)

For Uston, the importance of guarded play is not simply a matter of the long-term fixation on the high score. Revealing another potential aspect of the arcade’s context and influence, adopting a tentative approach to public performance serves also to protect the unintentional revelation of one’s true level of expertise. Given the focus on the high score table, or at least on beating one’s own previous highest achievement, curtailing the use of the patterns in public might seem at odds with the entire project of mastering Pac-Man. However, in a section headed “Hustling Pac-Man,” in which he considers playing Pac-Man for money, Uston encourages the reader/player to consider the wisdom of showing their hand through overly confident play.

> The betting Pac-Man player who is being observed by a potential “mark” (though I am not encouraging betting) would do well not to expose his knowledge of patterns, and should play a “fairly good” improvisational game. … During a game in which bets are involved, the player is advised to attempt to vary his pattern. This may keep the other player from observing board after board of your basic pattern and memorising it for use against you. (Uston, 1982, p. 123)

As well as noting the positioning of Pac-Man within the context of gambling, and the way in which the virtual consumption of dots and literal consumption of quarters might be inverted/converted into real winnings, we are reminded of a fundamental feature of Pac-Man’s structure in these discussions. As the game lays bare its extent and, as we

patterns becomes problematic and the very repeatability and learnability that make them enticing leaves the player vulnerable. Worse still, in the act of execution in play, they potentially teach their opponent just as Uston et al. taught them in print.

It is very clear that the patterns developed and codified in these various guides are profoundly affected by Pac-Man's arcade context. The arcade exerts limits on the nature of the access to the game and gameplay while also provides an opportunity for its personal and manifest performance and consumption. However, viewed also in the light of the labyrinthine procession and the ordering of randomness, I argue that the didacticism and imperative nature of the instructions in these 1980s Pac-Man guides is revealed as only partly connected with the requirement for precision timing. Coupled with the promise of ever-increasing scores, there is a palpable sense in these texts that the literal paths set out before the would-be player lead to both personal attainment and fulfilment.

1.5. 3,333,360, the Split Screen, and the unexpected perfectibility of Pac-Man

Thus far, our analysis has centred on revealing the particular construction of Pac-Man as it is expressed through Uston's (and others') patterns for play. We have noted the influence on these strategies and tactics of the context for accessing and performing gameplay. However, there is something altogether more impactful that influences the contours of these approaches and comes to define Pac-Man's textuality. In the pages of the various paperback guides, Pac-Man is presented as an infinitely cycling game. Pac-Man in the 1980s is understood and presented as a game of masterable technique but unending ludic opportunity.

> People watching me play often ask, "Are you beating the machine?" The answer to this is "No" since, like death and taxes, the end of the game must inevitably come. The exception to this rule might occur when, like my San Francisco friend Raymond, you amass such a huge score that you walk away from the machine in midgame out of sheer boredom or fatigue. That might be considered a victory over Pac-Man—that is, you have played all you wanted for your quarter and choose to do something else.
> (Uston, 1982, pp. 123–124)

In fact, similar stories may be found in other contemporaneous books. "[Ed] had been

got eaten but because he had to leave: He had lost only one man and had three to go." (Kubey, 1982, p. 52). In fact, elsewhere, (p50), the endless structure of Pac-Man is unequivocally confirmed. "And one of the GET brothers created Bazo's Breaker, the near-perfect way to deal with all the tables from the Ninth Key to infinity," (Kubey, 1982, p. 50). More prosaically, Uston considers the possibility of finally conquering the game. Throughout the pages of the various paperback guides, Pac-Man is presented as an infinitely cycling game. Patterns for either or both the Slow and Fast Games and sometimes for some of the many unauthorised bootlegs and modifications in circulation in arcades are offered up to the fabled "Ninth Key" after which it is agreed by all authors that the game serves up mazes that may be tackled by a single pattern (albeit requiring precision timing in execution and offering an extremely great challenge). As Mulliken (1982, p. 4) observes, "Note: The chart stops at the 9th Key; this is because at this point, the machine keeps giving you the same pattern." As such, Pac-Man here is understood and presented as a game of masterable technique and, importantly, unending ludic opportunity.

For the reader today, this evocation of Pac-Man as a game playable ad infinitum (or perhaps even ad nauseam) is a particularly noticeable feature of the texts and reminds us that the material that is absent from these analyses is just as important as that which is present in formulating the distinctive construction of the game. Quite simply, there is no mention in Uston's work of the "killscreen," the game-ending glitch that bars progress beyond level 256, and which comprehensively alters the game's ludic opportunity and challenge. As (Burnham, 2003, p. 235) notes, "In 1999, at the Funspot arcade, celebrity player Billy Mitchell performed the first recorded perfect score of 3,333, 360." To be clear, I am not suggesting that discussion of the killscreen, or "Split Screen" as it has become known among aficionados, was consciously omitted from Uston's work. Rather, as evidenced in the assertions about the game's endlessly cyclical structure, it seems the existence of the Split Screen was simply not known of.

Although its revelation may have come later, it is difficult to overstate the significance of the glitch on both the textuality of the game and its ludic opportunity. The discovery of the Split Screen at once repositions Pac-Man as not only masterable but, most crucially, perfectible. There is no longer merely the search for a high score but rather the certain knowledge that there exists a maximum score. What is so ironic about the situation in the 1980s is that the manifest desire to beat Pac-Man was confounded by the mistaken belief that the game was infinite and unending. That it was assumed that

end of the game came only when the last Pac-Man was lost or the player lost interest and quit. Either succumbing to the challenge or becoming bored of it were the only conceivable conditions under which the player would reach the “Game Over” text.

Following the revelation of the Split Screen’s existence, the desire to understand Pac-Man noticeably shifts, taking advantage of new modes of access that are connected, at least in part, with the accessibility of the game outside the confines of the arcade and the availability of tools that allow the interrogation of the game’s systemic operation. The use of disassembled source code and software analysis tools enables the dissection of the underpinning algorithms by which its gameplay is constituted. Don Hodges is among those whose ongoing research is dedicated to explaining the operation of the glitch.

> When level 256 is reached, it is counted by the game as level 255 (this number is #FF in hexadecimal). The subroutine is called to draw the fruit and the value for the level wraps around to zero when it is incremented. No check is done to see if the Carry flag is set, which would have been one way for the programmers to realize the game has reached this point. So with the counter at zero, this causes the subroutine which draws fruit to think that it is a level less than seven with only 1–7 fruit to draw, in addition to some possible blank spaces.
>
> The program starts drawing fruit with the counter in register B set to zero, instead of the expected number from 1 to 7. At the end of the loop, B is decreased by one and checked for zero. If it is not zero then the loop runs again, if it is zero then the subroutine ends. On level 256, B is zero to begin with. It is decremented at the end of the loop, which makes it roll back down to 255, causing the loop to run a total of 256 times, which is why the split screen gets drawn on this level.
>
> (Hodges, 2007–2015)

Such scrutiny of Pac-Man’s foundational operation is demonstrably driven by the desire to apprehend it as a mathematical model rather than only as a series of patterns to be learned or monsters with distinctive characters and personalities. And perversely, it is this mode of analysis that reveals the game to be anything but infinitely cycling but rather eminently beatable and ultimately, and fatally, flawed.

However, and demonstrating a sense of disbelief, or at least an unwillingness to accept, the finality of Pac-Man's newly discovered structure, players have sought to tackle the killscreen as a new challenge. Most obviously, the challenge initially shifts from merely completing the game and becomes a race to the Split Screen and the maximum score with the current record held by David Race with a time of 3 h, 28 min and 49 s as adjudicated by Twin Galaxies (twingalaxies.com). Recapturing the spirit of exploratory play evident in the performances and practices of the 1980s pioneers, Pac-Man players, researchers and codeminers continue to search for routes through glitch.

An interesting coda to the Split Screen narrative is found in Sykora and Birkner's (1982) "The Video Master's Guide to Pac-Man," as it is in this volume that we note a description and, crucially, an illustrated facsimile of the Split Screen. Published a few months after the raised edition of Uston's "Mastering Pac-Man," the text accurately describes the fracturing of the game's display, the chaotic nature of the monsters' movements and identifies the board as the product of a malfunction. The image is certainly vividly reminiscent of the Split Screen, though ultimately gives an impression rather than a perfect rendition. Intriguingly, however, the high score listed falls short of the maximum.

> To the best of our knowledge, the world's record Pac-Man score is held by the book's co-author and consultant John Birkner. His best score stands at 3,214,270. Although he has come close to breaking his own record several times, he has been unable to because of the machine's "limited" capacity. (Sykora & Birkner, 1982, p. 63)

Even though the Split Screen's presence is recognised, there remains a detectable desire to explore the potential to push beyond in score at least, presaging the investigations that continue to this day.

1.6. Beyond the ninth key

Just as the labour of modern players and codeminers is manifestly evident in their copious analyses, Uston et al's work in compiling these guides to Pac-Man (and, indeed, other video games) clearly represents a considerable endeavour and makes use of its own specific methodologies. Exploring and testing through countless hours of play, unsuccessful and inefficient patterns are discarded leaving only the most effective that are canonised and codified. Their independence from the development of the games

lineage to the player-produced walkthroughs and FAQs available online today. There is a palpable sense of mastery captured in both these ancient and modern texts, though in the 1980s, the fruits of the inestimable ludic labour are imparted with an, at times almost condescending, didacticism that promises to support the inexpert player in their efforts to achieve competence if not greatness. The authors of these guides are unequivocally positioned as experts and the patterns that they derive and test through rigorous, investigative, masterful play are to be slavishly reproduced with precision timing. In these books, the lists of patterns take on the allure, mystery and, importantly, the ludic (and potentially commercial) value of the pirate's treasure map while in their transformation of the complexity and multicursality of the maze into single, processional routes, they simultaneously offer a literal pathway to personal attainment, if not to perfection.

I hope that the exploration of different approaches to Pac-Man as responses to the contextual demands of the game and as embodiments of specific and distinctive appreciations of its structure and ludic opportunity demonstrates how Pac-Man's textuality has shifted dramatically between being defined by movement through the maze to an appreciation of the centrality of the monster AI—and from ignorance of, through recognition of, and latterly to the celebration and canonisation of the Split Screen glitch.

We might characterise the two approaches, respectively, as embodying the desires to "beat" Pac-Man and to "apprehend" it, even though, ironically, we note the frustration in the attempts to "beat" a putatively "unbeatable" game and the need to impose one's own definition of completion. Of course, both approaches clearly respond to the game's location in specific contexts which might, to a greater or lesser extent, directly link Pac-Man's consumption with the player's expenditure via, for instance, the arcade machine's coin-box. And certainly, there is a clear sense in Uston's and Kubey's work, for instance, of the public performance and consumption of gameplay that reminds us of the essential nature of gameplay spectatorship, its historical roots and interactions with play, learning and pleasure.

While the gameplay that is revealed through the patterns frozen onto the pages of the 1980s guides is certainly impressive, it is ultimately the imperfect knowledge of the game's potential (with the exception of Sykora and Birkner's work) that frames and shapes the understanding of the way in which it should and could be approached.

Corrigendum

This article was originally published with errors. This version has been amended to correct the current Pac-Man record. Please see Corrigendum (http://dx.doi.org/10.1080/23311983.2017.1284177).

Additional information

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Notes

1. The monsters are sometimes referred to as "ghosts," though the derivation of this

attempt to postrationalise the graphical limitations that saw the characters flicker as the system struggled to redraw them (see Montfort and Bogost (2009) and Wiswell (1983, p.71) on “Flickerman”).

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