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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 dra

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1. Introduction: How to beat the video games

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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 [Pac-Man: The Official Strategy Guide](#) in early 1982, two years after its publication. This 157-page paperback book, written by [John](#), his



At the time, I was a novice programmer and expert and was far from an expert. I have

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, it is not surprising that the game has become a subject of surprise and evocation that is quite different from those on the approach to understanding the reading of different

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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-

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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

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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. It had to have the demand for the game in 1981, in the US, there were over 100,000 copies sold. According to Wikipedia, more than 1 billion copies of Pac-Man have been developed for computers and derivatives. In 2015, the



beach towels, curtains, paperweights and stickers, barely a moment needed pass or a quotidian function be performed without Pac-Man close at hand.

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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



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.

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1.2. Of monsters and mazes

Additional Information

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.



In fact, a ... sees eating

In this article



Pac-Man can render vulnerable the monsters and gain yet more points as the tables are

turned and they are consumed.

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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)

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Abstract 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.

1. Introduction: How to beat the video games

Additional information Patterns, tips and strategies for doubling, tripling, and even quadrupling your score in the game that's sweeping the country!

Footnotes (Uston, [1982](#): Front cover)

References 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 on a ROM chip. The game's cover art, featuring a yellow and black and decal-adorned cabinet, was a testament to the game's popularity. The game had appeared in arcades across the world. However, it is important to note that the game's design and operation were not perfect facsimiles of the original. The game was often played with K.C. Munchkin, a character that even set the game apart from other licensed Pac-Man cartridges.



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.

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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

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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

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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

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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



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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)

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Abstract ... 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.

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Additional information (Uston, [1982](#), p. 11)

Footnotes The nature of the research is absolutely crucial. Where video game strategy guides

References 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, the case of Pac-Man has noted, in order the kind of methodical right ways of modifying weren't stuff" new units with a of these "two diff p. 11), distinct games. In fact, alth boards/mazes is altere ss the two

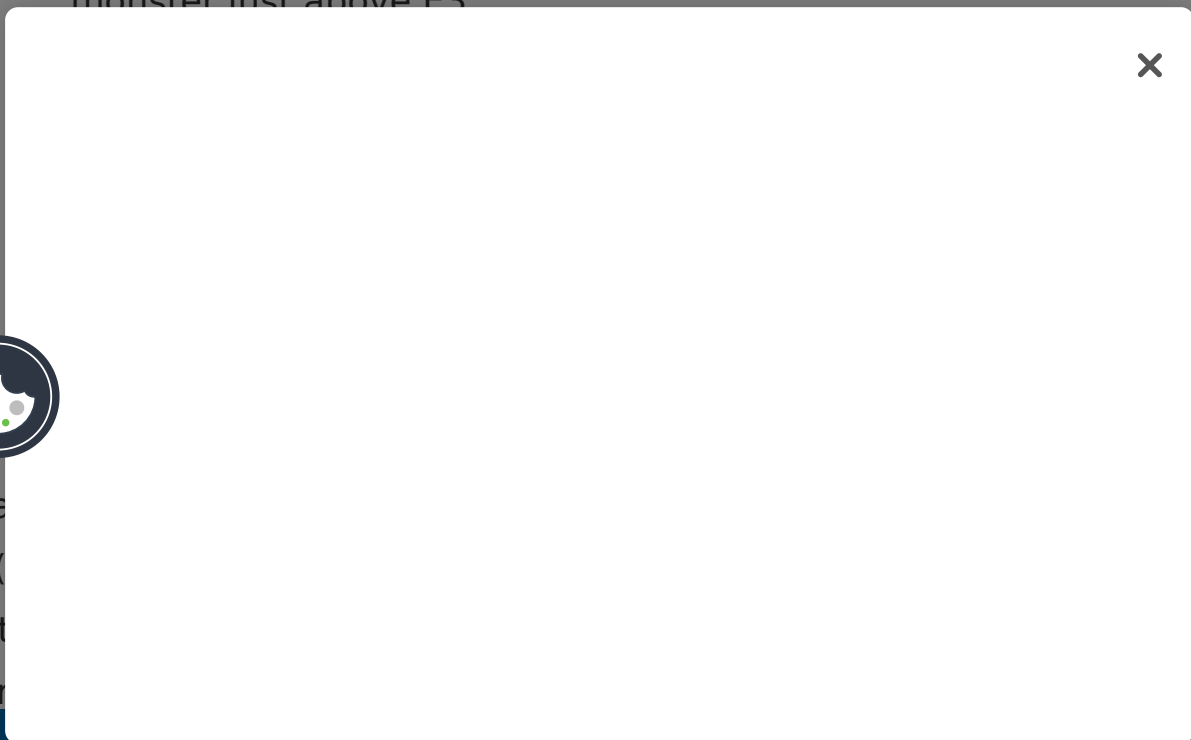


Abstract There is a direct correlation between the velocities and movements of the men in the Slow Game and the Fast Game. Thus the player may use identical patterns whether playing the Slow or the Fast Game (the one exception to this is the unique pattern required for the first board of the Slow Game).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

References 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



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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.

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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 noted in the previous section, the "9Key" and other patterns developed in the 1980s not only alter the way Pac-Man is played but also fundamentally alter the way Pac-Man is understood. This is tamed as a pattern may be seen in Pac-Man's reverential tone of voice when he approaches

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.

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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



term tactical opportunity to maximise the points per board/maze. In this particular race,

Pac-Man is the tortoise not the hare.

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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



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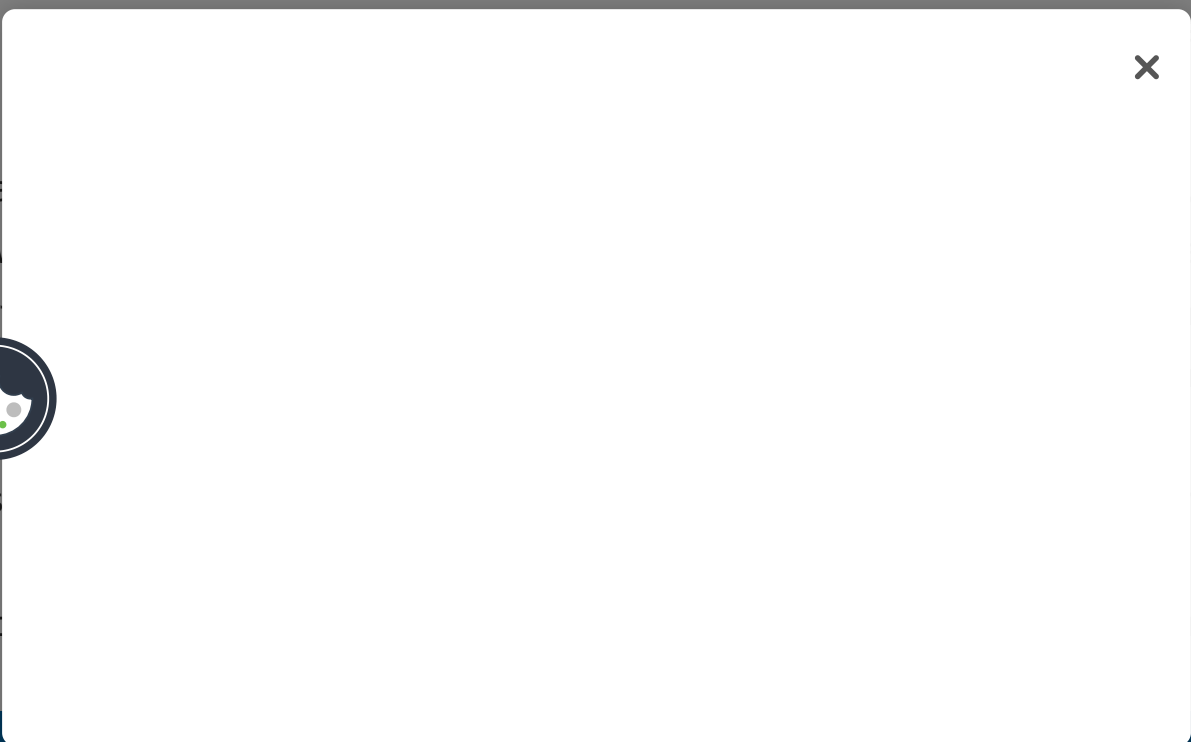
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Abstract but for fun and to delight his fans. Here this pattern will be called the Donut Dazzier. The Donut Dazzier frightens and amazes spectators because at three different points it has the Pac-Man chasing right on the heels of one or more Monsters, 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



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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



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got eate... three to go."
(Kubey, ... Man is



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

Although the significance of the discovery of the Split Screen is most crucially about the situation of the machine, the mistaking of it could be seen as the end of the game and quit

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.



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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.

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An interesting coda to the Split Screen narrative is found in Sykora and Birkner's ([1982](#))

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"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

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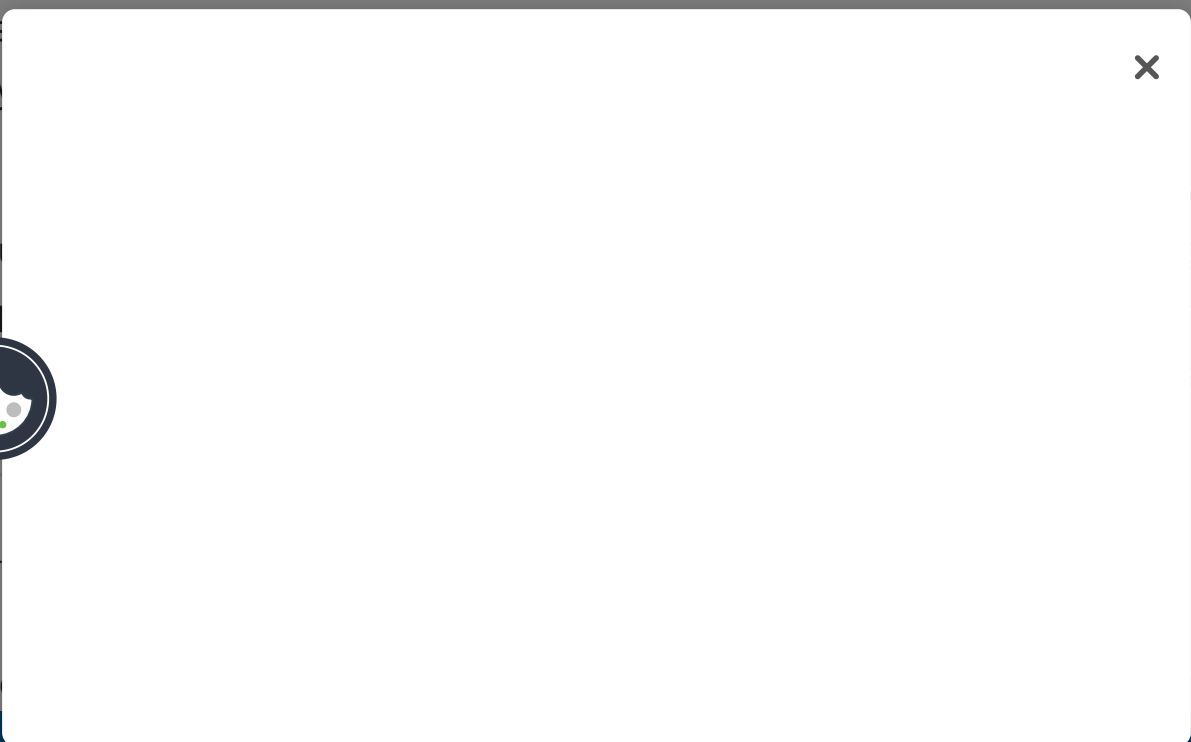
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unequivocally positioned as experts and the patterns that they derive and test through rigorous, investigative, masterful play are to be slavishly reproduced with precision timing. In these books, the lists of patterns take on the allure, mystery and, 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



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James Newman is a professor in the Digital Academy, College of Liberal Arts at Bath Spa University. He is the author of numerous books on video games and gaming cultures including Videogames (Routledge 2004/2013 s edition); Playing with Videogames (Routledge 2008); and Best Before: Videogames, Supersession and Obsolescence (Routledge 2012), 100 Videogames (BFI Publishing 2007) and Teaching Videogames (2006 BFI Publishing). James is a co-founder of the UK's National Videogame Archive, which is a partnership with the Science Museum, and a contributor to the GameCity family of projects. He is currently an advisor on the Game Metadata and Citation Project (University of California Santa Cruz) and a board member of the UK's National Videogame Arcade. In 2015, James was awarded an EPSRC Sustainable Society Network + Researcher Mobility

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