

A Quest?!: The Secret Life of Gameworld Punctuation

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At times, the interfaces of videogames – gameworlds – contain tiny details that go unnoticed. One such detail is how designers employ ! and ? to communicate to players. These punctuation marks have existed in videogames since their creation, yet remain undiscussed by designers. They are used as ways to promote curiosity, as objects, as ways to symbolize excitement, and as a prompt to react. Their varied history is deserving of attention, so we present a chronicle of two pieces of gameworld punctuation: ! and ?. We discuss current and past uses and identify more ways that these could be used in the future. These symbols may present a useful space of inquiry not only for games and games research, but more generally, in terms of the rapid communication of complex information.

CCS Concepts: • **Human-centered computing** → **HCI theory, concepts and models; Interaction design theory, concepts and paradigms**; • **Information systems** → *Collaborative and social computing systems and tools; Massively multiplayer online games.*

Additional Key Words and Phrases: ?, !, cues, history, video games, videogames

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1 INTRODUCTION

The present research develops a history of the uses of ! and ?¹ in videogames in service to understanding their value as a design element. Is this an unconventional quest? Yes! But it is not the quest that matters, but what we learned along the way: that these marks are useful components of design and help playfully connect players to a gameworld. As such, designers can use them in similar ways to signpost content for users.

Play is the act of figuring out how things work within a space (e.g., a magic circle [42, 79] or playground [8]) that includes limits, affordances, and its own consideration of time [8, 42, 79]. Gameworlds are spaces designed with certain kinds of information-based activities in mind [48]. These activities are the essential component of what players “do” inside of a gameworld be they quests, jumping on mushrooms like a spring, punching trees to get wood, or taking control of a group of dwarfs in a fantastical world.

¹While we discuss a number of terms for these symbols, in this paper, we pronounce them as “exclamation point” for ! and “question mark” for ?.

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Since their creation, games have been a leader of the bleeding edge of consumer technology. Every advance in computation – e.g., faster processing, better graphics (or the advent of graphics at all), new input technologies, precision sensing, new uses for logic, virtual and augmented reality – is gleefully commandeered or developed in the service of play [15, 22, 62, 78, 82]. Recently, “retro” games – games whose designers restrict themselves to the limits imposed by earlier forms of technology – have become popular, which means that all old development trends are being re-considered at present [84, 85]. Through that context, an exhaustive history of videogames, their gameworlds, and their gameworld interfaces provide us with a history of innovations, playful adaptations, and other design decisions game creators made given their constraints at the time.

This history often goes overlooked due to the focus on the bleeding edge. Historians foster taxonomies [3, 17, 64, 77, 88] while developers write postmortems (e.g., those at the Game Developer Conference²), design documents (e.g., those created and used by a design team to make a game), and white papers [30, 36, 61] – documents that are generally available to professional designers, sometimes *only* within particular organizations. The present research explores how videogame design history can provide insights for building new forms of play.

To seek history for history’s sake in the technical spaces is rare. For example, the December 2022 special issue of the *Transactions of Computer-Human Interaction* (TOCHI) presents this idea through its theme: (Re)Connecting History to the Theory and Praxis of HCI. An additional publication at the 2021 ACM Conference on Computer-Supported Cooperative Work and Social Computing (CSCW) [81] are some initial forays into making the history of technology part of the study of technology within human-computer interaction (HCI).

To wit, we make three contributions to the study of games in their historical contexts in the present research. First, we contribute a history of how the pieces of gameworld punctuation – ! and ? – have been used over time; and thus, how players (and/or users) are likely to interpret them. Second, we contribute to the study of games by providing an in-depth discussion of method focused on how to analyze data like these. Finally, we suggest parameters for the future use of gameworld punctuation in design, while calling for increased attention to them.

To make these contributions, we synthesize a combination of first-hand evaluation of games along with print materials, Let’s Plays³, and online discussions to contribute a history of the usages of ? (ASCII: 3F⁴, UTF-16: 00 3F⁵) and ! (ASCII: 21, UTF-16: 00 21) in videogames. While this history may seem minor, the present research is a rich, thought-provoking insight into design decision history as well as cross-medium and cross-cultural contexts. These two punctuation marks, mere 8- or 16- bits in their substance, have, in videogames, denoted everything from potions in games like *Angband* [Ang] or *Rogue* [Rog] to moods in games like *Dwarf Fortress* [DF]. Yet, their origin, history, and systematically evaluated contexts remain mostly unknown save for oral history, wikis, enthusiasts, and fans.

The present research is structured first by expounding on the contextual history of the gameworld punctuation symbols: ! and ?. Next, we examine the background of research relative to history-centered discussions of semiotics, symbolism, comic books, advertising, the general appearance of

²<https://gdconf.com>

³Videos of players playing a game live and, often, commenting on the experience, which may be livestreamed and/or recorded [35]. Let’s plays are (typically) guided explorations of games from the perspective of a fan of the game or someone who is new to the game. An archive of let’s plays can be found at <https://lparchive.org/> as well as Youtube, Twitch, and web communities like Reddit or SomethingAwful.

⁴ASCII, the American Standard Standard Code for Information Interchange [37], is one means of encoding characters that was commonly used until it was largely replaced by Unicode [6].

⁵UTF-16 is the 16-bit Unicode Transformation Format used to specify characters in the Unicode format to enable their transmission and display on computers [87].



Fig. 1. [Nioh]::SOMETHING NEW!. In *Nioh* [Nioh], players find new equipment, enemies to fight, and environments as they wander the gameworld. Each time this occurs, the designers punctuate this event in the gameworld with an ! [LEFT]. If the user clicks one of these items on the menu, sub-menus will then feature another ! next to any slot they have new entries for [CENTER]. Once a player explores the new items in their inventory, the gameworld punctuation ! will disappear from the list [RIGHT]. The way [Nioh] uses SOMETHING NEW! is repeated in [TOW, YMB, D:OS] with small differences.

As we continue to discuss our themes and uses of ! and ?, we will include examples from our corpus as figures. Each will display a 3-image panel and long caption.

ASCII text in games, and symbolic interaction. We describe our data, our sampling criteria, and why a landscape sample provides the most useful type of purposeful sampling for projects like this. Last, we analyze our sample and discuss its implications (see an example from *Nioh* in Figure 1) leaving the reader with a number of takeaways and need for future work.

2 A HISTORICAL WAY OF KNOWING

We use *historical ways of knowing* [57], synthesizing sources across multiple media. We delve back to the origins of our punctuation marks – ! and ? – and trace their use in videogames up to the present time. The result is a chronicle of the diverse usage of these symbols in games, demonstrating how designers have converged on a common set of uses of gameworld punctuation.

2.1 Researchers' Standpoint

This account is based on – and limited by – the authors' understanding of the history of videogames. Other researchers, working from different perspectives and additional sources, could arrive at alternative conclusions. We inhabit a position of partial perspective [38].

To assess interpretivist research, the reader needs to understand the standpoint (i.e., Hartsock's standpoint theory [39]) of the researchers. We provide insights into the researchers' collective backgrounds to lend credibility to the process and support the reader. This does not assert our objectivity or expertise. Instead, we offer the reader tools to interpret the work for their own purposes and bring their own expertise to assess where there is need for additional insights.

The three authors are well-played (i.e., have spent many decades consciously immersed in games, their history, and their culture [18], which assists in identifying games that should be relevant to building a corpus) HCI researchers, and all authors were involved in data collection and analysis. Two authors have additional experience in emergency management research, which focuses on symbology as an organizing element. One author has formal education in humanistic areas with particular focus on critical theory. The authors collectively speak from a white perspective from the USA; the team represents a balance of gender identities and is neurodiverse.

Table 1. Games Corpus arranged by year of platform-specific release.

Title	Release Year	Platform Investigated
<i>Mario Golf: Super Rush</i> [MGo]	2021	Nintendo Switch
<i>Desperados III</i> [Des3]	2020	Windows
<i>Etrian Odyssey IV: Legends of the Titan</i> [EO4]	2020	Nintendo 3DS
<i>Magic: The Gathering Arena</i> [MTG]	2019	Windows, MacOS
<i>The Outer Worlds</i> [TOW]	2019	Windows
<i>Dead Cell</i> [DC]	2018	Nintendo Switch
<i>Mark of the Ninja</i> [MN]	2018	Nintendo Switch
<i>The Legend of Zelda: Breath of the Wild</i> [LZ:BW]	2017	Nintendo Switch
<i>Nioh</i> [Nioh]	2017	Playstation 4
<i>Stellaris</i> [Stel]	2016	Windows
<i>You Must Build a Boat</i> [YMB]	2015	iOS
<i>Divinity: Original Sin</i> [D:OS]	2014	Windows
<i>Old School RuneScape</i> [OSRS]	2013	Windows
<i>Diablo III</i> [D3]	2013	MacOS
<i>Final Fantasy XIV: A Realm Reborn</i> [FF14]	2013	Windows, MacOS
<i>XCOM: Enemy Unknown</i> [XC:EU]	2012	Playstation 3
<i>Professor Layton and the Curious Village</i> [PL1]	2008	Nintendo DS
<i>Ōkami</i> [Okami]	2006	Playstation 2
<i>Dwarf Fortress</i> [DF]	2006	Windows
<i>Monster Hunter</i> [MH]	2004	Playstation 2
<i>World of Warcraft</i> [WoW]	2004	Mac OS, Windows
<i>DiabloII</i> [D2]	2000	Windows
<i>Metal Gear Solid</i> [MGS]	1998	Playstation
<i>Pokémon Red</i> [P:R]	1998	Game Boy
<i>Minesweeper</i> [MS]	1990	Windows
<i>Angband</i> [Ang]	1990	Windows
<i>Metal Gear</i> [MG]	1987	NES
<i>Super Mario Brothers</i> [SMB]	1985	NES
<i>Q*bert</i> [QB]	1983	Mattel Intellivision
<i>Rogue: Exploring the Dungeons of Doom</i> [Rog]	1980	Unix

2.2 Sampling Approach

While a number of databases of games and their features exist (e.g., MobyGames⁶, Giant Bomb⁷, Game Design Patterns⁸, TV Tropes⁹, the Game UI Database¹⁰), none directly address the player interface specifics we are investigating. The present research is an offshoot of another project looking at designing agents (e.g., robots, virtual assistants) and how videogames might inform the

⁶<http://mobygames.com/>

⁷<https://www.giantbomb.com/games/>

⁸http://virt10.itu.chalmers.se/index.php/Main_Page

⁹<https://tvtropes.org/>

¹⁰<https://www.gameuidatabase.com/>

design of their social cuing behaviors. In that project, a number of the games featured cues with ! and ? to alert the player to game state and we wondered from where this convention arose.

We used the ludography of our prior project as the basis for this one. We further relied on our personal knowledge in identifying suitable games that fit into our particular corpus with additional help from the tenets of purposeful sampling [70]. A core part of this work involves working from our own knowledge as gamers and scholars to build up a corpus, guided by our research focus.

The present corpus is not exhaustive, but based on the landscape sampling concept outlined by Bos et al. [9], which seeks to provide an overview of types and expressions in an effort to give designers a history that is abbreviated but focused. Many consulted sources provided games and insights that led to identifying appropriate games. Sources included books [15, 16, 22, 24, 28, 29, 52, 54, 62, 72, 78], web fora [67, 94, 96, 97], and podcasts [33, 50, 73]. Most importantly, these texts led us to our primary data sources – the games themselves.

We acknowledge that new games are released constantly and that we are only able to bring our particular perspective to bear. Working from a well-played [18] perspective helped us to build out our corpus and draw connections between the games encountered. Our expectation is that this produces a *useful* chronicle for HCI-centered spaces about how ? or an ! have been used in videogames over time.

2.3 Reporting Conventions

We develop a *Ludography*, a references section that provides cite-able sources for our data corpus. This data corpus does not include *every* game that uses a ? or an !, only a landscape of 30 games. As a notation for citing games from the Ludography, we use an abbreviation of the name, in hopes this helps the reader identify the game quickly. For example, *The Legend of Zelda: Breath of the Wild* [LZ:BW]. Where possible, we will mention the name of the game the first time an item from the ludography is mentioned. In many cases, the use of ! and ? are common to a whole game series – in this case, we ensured the first game in the series with an ! or ? is included in the Ludography and cite it; if others appear, they are included in the citation.

3 WHENCE COMES THE ?! (?)

Videogames tend to use ! and ? in the same way that written works (e.g., novels) do, but also add their own definitions. This section begins by briefly examining the standards set by written language for the usage of those symbols. The history of punctuation is longer and more complex than we have space for. In light of this, we recommend a few texts for readers who wish to explore that history in greater depth: Adorno [2]; Allott and Alcinus [4]; Bernstein [7]; Dürrenmatt [27]; and Humez and Humez [43].

3.1 Concerning Question Marks

While the history of punctuation is a history of written communication, ! and ? did not always precede or follow a written sentence. Punctuation was not regularly seen until the ancient Greeks and Romans began to use the . (*punctus*) to mark pauses and the end of sentences [14, 43]. Subsequent innovators followed this template, and created punctuation marks that were dot-based; however, these symbols' position in the sentence varied, as did their meanings. This innovation resulted in punctuation that was nearly all dots. Various other symbols would be added above or below to signify inflection, pauses, and other kinds of speech patterns [14, 43].

The history of the ? is subject to question – most historians accept that the mark originated with medieval-era musical notation indicating a rise or lowering of tone at the end of a stanza [43]. This ancestor of the modern question mark, which more resembles a modern comma atop a period, is

known to have been used by Alcuin of York, Charlemagne’s historian. By the mid-9th century, ? was widespread among those who could read and write [4].

The shape of the *punctus interrogativus* (the English name ‘question mark’ dates from the 1800s) evolved over the centuries. By the 1300s, the *punctus interrogativus* had taken on its current form and standard position at the end of sentences. Prior to that, it saw widespread use not just to end sentences and indicate questions, but also to separate clauses and provide pauses [27].

In the 20th century, with the appearance of computer programming and comic books, the question mark developed new, subtly different meanings. In one case, a query to a database and in the other, a sense of perplexity, confusion, or incomprehension [27, 43]. It is these meanings that have been adopted by games.

3.2 Concerning Exclamation Points

The exclamation point (e.g., a “bang”, “screamer”, “pling”) [43] has an origin more muddled than the question mark. The most plausible story is that Iacopo Alpoleio da Urbisaglia, a 14th-century poet, invented it and called it the *punctus admirativus* [43, 59]. By the 17th century, its meaning had drifted from a mood of admiration to excitement [43, 59].

In the early 20th century, comic strips – and, by the middle of the century, comic books – began to shift their use of punctuation at the end of sentences, from periods to exclamation marks [27]. This was in part to convey a greater mood of excitement to the reader, but far more pragmatically, techniques for printing hand-drawn illustrations on newsprint were primitive, and periods – the smallest character – risked being lost. The head of Marvel Comics, Stan Lee, sought to ban them entirely from comic books [27] – they were in nearly every speech bubble. It was so pervasive that when the Adam West *Batman* television show aired, its signature BAM! WHAP! BIFF! stylings were lifted from the pages and reduced in the number of exclamation marks [27, 43].

3.3 A Shift in Usage

The history of these two pieces of punctuation resembles current changes in language resulting from the rise of the internet and, subsequently, the appearance of mobile devices. While these symbols are part of this shift in language, the physiognomic meanings (external characteristic discerned from an outward appearance) [2] of the ! and ?, developed through their use in comics, was central to their use in early games like *Super Mario Bros.* [SMB], *Rogue* [Rog], and *Metal Gear* [MG]. Once those pioneering games used those symbols, their meanings within game culture were established, and would only expand. In the next section, we untangle the history of these symbols, and connect them to research surrounding human factors engineering, game design, and their presence in other media.

4 BACKGROUND & MOTIVATION: TRACING ! & ? THROUGH TIME & MEDIA

The use of punctuation – the ways that the meanings of symbols have evolved over time – overlaps human factors and HCI, as it is connected to the discussion of symbols and icons on machine displays [31]. Within HCI, the role of semiotics – the study and development of signs and icons – is to help users connect to a product [21]. These symbols are not used as icons or given representational value other than the direct, surface-level meaning: what Adorno [2] called their “physiognomic status.” Bernstein [7] noted that “Punctuation marks are the traffic signs and signals placed along the reader’s road.” This complements Adorno, in that one knows the signs are there even without seeing them; in addition, it also provides the segue between road signs and gameworld punctuation.

4.1 Defining and Contextualizing Gameworld Punctuation for the HCI Community

What *are* ! and ?? The most obvious candidate is that they are *punctuation*. They take any sentence and add context clues that readers use to fill in the intent of the speaker or author. Any sentence with an ! is typically exclamatory! Whereas the ? provides readers with curiosity? When the punctuation does not match the sentence (as in the case of the last 2 sentences), our expectations of the meaning of those symbols moves from unconscious to conscious.

As an *icon*, we rely on the punctuation meaning of the ! and ? to understand the context of its use. When we use the word icon or pictograph, we refer to a similar concept – small pictures that represent something. In the case of icons, these are typically objects (e.g., the “Save File” command is an icon of a disk) whereas pictographs represent ideas (curvy road ahead, steep incline, slippery when wet) [34]. The concepts blend quite often.

For example, when I print things in my office, I am often left glancing at a ! that is bouncing somewhere on my screen. This is an icon or pictogram that represents an object associated with the computer is currently in error or is not validating properly. Through that icon, that pictogram, that punctuation mark, I can reason out that I have (once again) forgotten to log in to my virtual private network (VPN) so that I am allowed to communicate with our printer as though I was on our wired network. The ! is shorthand for an object not existing, I do not have credentials to access the object, or that my connection request was rejected.

That meaning is further blurred. In text-based communication certain shortcuts and condensed meanings have resulted in the ! and ? being used in programs devoted to text-based communication. For example, if I say something to my partner and they do not understand what I mean, I may simply get a ? in reply. I unconsciously understand what this means and as such, react to the physiognomic. And at times, I may send a text message or image to my partner who then reacts by holding their finger over that sentence and selecting a ! to show that they are either surprised or bewildered by that message. To wit, we call the ! and ? (while also punctuation marks) *symbols* rich with meaning that transcends iconography, pictogram languages, and even punctuation. These are symbols that, when taken at face value, have meaning on their own; however, at times that meaning is changed by the context through which it is used and meanings are expanded. We believe that the term, “*gameworld punctuation*” best fits these terms.

4.2 Game Design: Gameworlds & Diegesis

Two key terms arise as we discuss the use of ! and ? in videogames: the notions of gameworld and diegesis. It is important to consider how games share information about the state of the game with the player as well as how the ways games share information aids immersing players into the game they are currently playing.

A *gameworld* is the virtual space in which we play games [48]. The gameworld is part game fiction, part playground, part user [player] interface [49]. While immediately recognizable “widgets” like buttons, icons, and menus are part of how we control and gain feedback from the gameworld interface [48, 49], so, too, are the virtual spaces in which avatars move, the objects they manipulate, and impassible barriers. These virtual spaces *are* interfaces and through the interaction between a gameworld, its interface, and the game system, how users can act within this world is communicated. These can be diegetic or non-diegetic.

The notion of *diegesis* comes from film and refers to the elements of the experience that are real in the context of the film [44, 69]. Non-diegetic components are not a part of the film- or gameworld, they are presented for the sake of the viewer or player. Soundtracks are often non-diegetic, though movies and games play on this by revealing that, in fact, a character was *listening to the soundtrack song*. In many designs, game user interface elements are not diegetic – indicators over characters’

heads, health bars, stealth indicators, and so on. At the same time, some games work with various conceits that enable diegetic user interface elements – first-person games in which the avatar wears a head-up display that shows relevant game information, for example [47, 71]. Gameworlds rely on non-fictional elements to bring users into their fictional or make-believe worlds.

4.3 Semiotics, Street Signs, Comic Books, & Advertising

4.3.1 Semiotics. At first blush, the ! and ? resemble signs, symbols, or the various objects that semiotics – the study of signs and symbols and their meaning – would focus on [21]. We believe that these two pieces of punctuation are themselves a sign, a symbol, a piece of punctuation, and at times, an icon. While this would partially point to semiotics, the more important aspect of these symbols is not their inherent meaning within the gameworld as signifiers of something else. While these punctuation marks are placed as icons or signs in some fashion, it is not their meaning inside of the gameworld interface that initially signifies, but their meaning outside of games entirely as punctuation.

For example, we could say that de Saussure’s sign [20] is signified by a single piece of ASCII text and yet, its meaning is multiple. There are a multitude of question or exclamation marks that could be contained within that symbol. While the gameworld interface will partially provide the reason for the symbol’s existence, players must react to the sign. They must react, not because of the gameworld, but because of the punctuation mark’s physiognomic meaning. It is this reason that the study of these symbols and their use are not entirely a matter of semiotics, grammar, linguistics, user experience, or any one field. What it does resemble; however, is the development of street signs.

4.3.2 Street Signs and Their Relation to Punctuation. The development of street and highway signs were an important part of human factors research throughout the middle of the 20th century because several things were happening. First, machined displays (later known as monitors) were starting to become normalized in the work environment. These new technologies, it was felt, could enjoy the research that produced standardized street signage [10, 34]. This research produced a significant amount of knowledge about how, how much, and what information humans could see and process in real time.

The work centered on every aspect of driving, from field-of-vision limitations due to windshield size to calculating the time required to look at some aspect of a display. This early research into human factors engineering produced what would become known as *socio-technical systems design*. Each step of the way of these professional, ubiquitous, and human-centered systems was discussed, obsessed over, tested, re-tested, and adjusted until a comfortable standard was found. It is still being adjusted.

This process reflects that of game design. However, in videogames, this obsessive design was not discussed. The reason for the public nature of street sign design was to minimize accidents and fatalities while the city was re-designed around the car [92]. The driving public was not the only beneficiary of this research.

The application of what was learned in studying the car, the driver, and the space of driving ultimately resulted in a line of research surrounding the nature of machine displays or monitors. What was found within this research was that symbolic languages, perceptual sets, much like that of Hieroglyphics, kanji, or Coptic, were superior to the amount of information they could transmit. This was reinforced by a comparison of road signs in Europe (which relied at the time on symbols) and roads signs in the USA (which primarily use words and letters at the time) [31]. The result of this work was the realization that one needs to design through the lens of the “stereotype symbol for a particular function” [31, p. 150]. As monitors replaced signs, paper, and plaques, this lesson

would be deployed as text-based output began to be shortened to symbols and icons [31]. This lesson, disconnected from games, would inevitably find its way into games through another route – comic books and print advertising.

4.3.3 Comics and Ads. Comics are “juxtaposed pictorial and other images in deliberate sequence, intended to convey information and/or to produce an aesthetic response in the viewer” [60]. This “deliberate sequence” is of particular interest because a reader must fill in the motion between panels. This form of art developed over centuries, but it was not until the moving picture that the idea of art-in-sequence was made manifest. Sequential art provides the basis of much of the use of ! and ? at present.

Throughout the 1960s and 1970s, the exclamation point began to be associated with gender in that exclamation points were seen as feminine and not masculine. This led to a decline in their usage in “manly” books (e.g. those written by Ernest Hemingway) [43]. Despite this attack on the exclamation mark, American writers and copy-editors in marketing firms were seeking out new ways to use the punctuation marks. The most famous of these marks is called the *interrobang* or a ! and ? mixed together: † The interrobang was short for interrogate and bang (how the exclamation point was referred to at the time due to comic book usage of the word BANG!). The punctuation mark was invented in the 1960s for a magazine called *Type Talks* by Martin Speckter. Initially, the mark was included in the font Americana and was also available to become a key on typewriters.

At the time, this new punctuation mark seemed like it would overcome the rampant overuse in media at the time; however, in the 1970s, minimalism began to dominate advertising, marketing, and entertainment media. All new marks disappeared. Yet the exclamation mark was left in comic books despite Stan Lee’s objections [27]. While this overuse would remain, a different approach to dealing with them was discovered:

“The fact that dialogue balloons in comic books may seem to have an awful lot of exclamation points in them says at least something about the whiz-bang nature of plot and dialogue in this artistic genre, but a more practical reason is that the printers in the early 19th century using workaday offset presses of the time, found that periods by themselves tended to disappear, while exclamation points remained largely legible. As a speech or thought balloon item by itself, the exclamation point serves to indicate surprise (as the question mark alone can indicate perplexity)” [43, p142]

And so, we see a mark that has a meaning outside of itself and its general usage both physically (though this matters little now) and as punctuation. We see the ! and ? essentially becoming a way to indicate surprise, curiosity, and other emotions commonly associated with them. This usage would appear in early videogames and come to gain a slew of meanings within the medium.

4.4 Early Games, ASCII, Roguelikes, and Borrowing from Comics

The first uses of ! and ? are found within the earliest videogames. Their use was not because of the meaning inherent to them that they appeared. Instead, it was because the first videogames used ASCII text as graphics because BBSes could not initially transmit graphics [32]. The reliance on alphabet and punctuation then, was not a matter of choice but something those initial designers were forced to use [46].

From early games like *dnd*, *pedit5*, and *Oubliette* for the PLATO system [22] to the genre-defining *Rogue* [Rog], the use of ASCII text, emoji, symbols, and signs began to re-define what a videogame should look like. *Rogue* was genre-defining because it was one of the first games that used ASCII text not because of BBS restrictions, but as graphics. Through the use of the curses programming library, the designers were able to place characters anywhere on the screen, thus moving ASCII text from text-based interfaces to graphical ones [46, 55, 89, 90].

The path from ASCII games to graphics-based games was not a straight line. Early development of educational software from the military's development of computation throughout the two World Wars would result in a bifurcated space. On one end was PLATO, developed from the concept of a Skinner Box (e.g., a box within which animals are tested and rewarded constantly), versus that of a personal computer (e.g., an independent machine users could do anything with) [22]. To make videogames, first users would have to learn how to use these systems to the point of being able to write software on them. Next, new tools and capabilities would need to be written in order to incorporate essential components from the most popular game in the world at that point, *Dungeons & Dragons* (D&D) [55].

What D&D did was provide a different way for computer-mediated games to be programmed and experienced. For example, whereas some of the earliest games like Draughts [58] emulated games like Checkers and some of the first popular games emulated games that required a ball due to the physics inherent to how a ball moves [45]. Games after 1974 tended to reflect D&D. For example, *pedit5* (later *The Dungeon*) provided players with a set number of variables (i.e., Strength, Intelligence, Dexterity, Constitution) that would be used in algorithmic fashion when the player's character was attacking a monster, trying to open a locked treasure chest, or trying to resist a powerful spell of mind control. This movement from parlor games to what we could refer to as "modern videogames" was dependent on the computer to perform all manner of calculation [55].

Each of these games were dependent on two things: (1) maps and (2) variable-driven play. While initially, play occurred on the map, these games would slowly disconnect the map from the space of play and make it into a referential object [91]. Between playing on a map to playing in a space, the use of ! and ? would see a increasingly diverse number of uses. These uses would gain diversity as different software and different philosophies of design would permeate their creation.

For example, in the United States through PLATO as well as ARPANET, games would see their D&D roots result in an increasingly complicated series of games. Games like *Rogue* [Rog] and *Angband* [Ang] would use these symbols because ASCII was the only option available and ! and ? could be used to represent objects. In Japan, the PLATO game *Oubliette* would be plagiarized [1, 22] and called *Wizardry: Proving Grounds of the Mad Overlord*. Enthusiast designers would see the overly complex game and boil it down to what is now referred to as the Japanese RPG or jRPG [15, 22, 55, 72, 91].

These boiled down games would kickstart an entire industry in Japan of streamlined game design [72]. One of those streamlined games released on the MSX2 computer system – *Metal Gear* [MG] – saw a crossover with comic books. When the player broke a straight line-of-sight of a standing guard, a ! would appear above their head and the guard would begin to attack. Further, inside of that game, when the player walked along a wall and punched it, when they found a hidden path a ? would appear. This simple use of the lessons learned from comic books would be replicated in other ways in other videogames. The use of these symbols are not simple semantics, their meaning derives from culture, is shaped by culture, and shapes culture. *Symbolic interactionism* can be used to describe this relationship.

4.5 Symbolic Interaction Over Semiotics

Symbolic interaction (SI) is a social theory meant to consider a micro-, or individual perspective, of how society, how culture, is manifested and maintained [40]. It originates with the hermeneutic philosophical tradition that seeks to understand interpretation [51]. With a basis on individuals and focused on pragmatism, it seeks to explain how humans make sense of the world around them and, in so doing, take actions based on the meaning that is created [40, 83].

Within HCI, SI has been used to understand cognitive work analysis or a method meant to analyze and model how sociotechnical systems work [51]. It has additionally been used in HCI as a

term to refer to the whole of HCI [101] since HCI is primarily concerned with the interpretation and creation of symbols. Rarely has it been *used* within HCI, but, given its tenets, we promote the idea that SI should be more prevalent, as it is compatible with not only information systems, but with activity theory [83].

Videogames contain symbols that are imbued with meaning by their creator. Within HCI, we understand that when people use software, they interpret it based on the software they had used previously [13]. This means that the intent of the designer is often juxtaposed against the interpretation of the user. The result is a cycle of interpretation of a task related to the artifact meant to mediate that task [12] that sometimes results in appropriation of an existing artifact for other uses [80]. What these symbols provide are a means through which to glimpse this cycle and to learn ways to bring other knowledge users already have into design.

4.5.1 Activity Theory and Symbolic Interaction. Perhaps the most pressing need in contextualizing the use of ! or ? is to address the use of SI in HCI. The use of SI for HCI is somewhat incompatible in a few different ways. SI concerns itself with the way that meaning of symbols are generated by and generate society.

Starr [83], outlines a variety of trade-offs and commonalities present among activity theory, pragmatism (this is the name of USA's version of SI), and computer systems. In particular, they focus on unpacking new units of analysis that could be used to understand how users were understanding information systems. Starr notes that:

“In exploding individualist explanations for activities such as cognition, dealing, and remembering, both interactionists and activity theorists created new units of analysis powerful enough to explicate how we are complicated in each others’ actions, including those actions usually thought private and individual.” [83, p308]

What this quote outlines is that meaning is derived not individually, but collectively.

The relationship between activity theory and SI is as such that SI affords researchers an ability to understand how meanings change. Through a quote from Howard Becker, Starr outlines how new meanings are derived: “a series of communicative acts in which others point out new aspects of [their] experience to [them], present [them] with new interpretations of events, and help [them] achieve a new conceptual organization of his world, without which the new behavior is not possible.”¹¹

What this quote indicates is that in the case of ! and ?, design teams will understand how these marks are currently being used in other games. These are the communicative acts. What is then changed is that their own designs will shift based on interpreting those communicative acts. At times, that interpretation will result in new communications to players which, in turn, will be expected or assumed for other games in which those features appear. What Starr ultimately concludes with is, “we cannot find a rational, reliable resting place in the old way by falling back on ideas of routine, standards, and universal reliability—we are in the processing of discovering that it’s local all the way down, including the work of transporting it across locales” [83, p312].

4.6 Contextualizing Gameworld Punctuation

What exactly are ! and ? in the context of the present research? They are symbols that span text, punctuation, iconography, pictures, and that they contain meaning in and of themselves resembling that of hieroglyphs. Or, in essence, they are all of those things and none of them. Yet, from this point on we will refer to them as gameworld punctuation.

¹¹Quote edited to be more inclusive.

While complex, storied, and overlapping, the history of games affords us a series of logical jumps to understand contextually how gameworld punctuation – ! and ? – came about. First, they were used because BBS systems did not allow for non-text-based graphics to be used. Then, through the curses programming library and through PLATO’s mainframe, we saw games begin to use graphics, but, because of the era – that of street signs and human factors – designers used text to represent objects while expanding their uses. After gaining graphics, videogames became international and Japanese designers provided new uses for ! and ? in the form of blocks in *Super Mario Bros.* [SMB] and exclamations of surprise in *Metal Gear* [MG]. After this, their uses would be relatively set though consistently expanding through games like *Diablo 2* [D2] and *World of Warcraft*. And the meanings of gameworld punctuation are, as Starr notes, local all the way down.

5 DATA

Our data is a collection of games that use the gameworld punctuation symbols of ! and ? in some way. Each game on this list is representative of a specific kind of use. In order to find and then vet these games, we first gathered game names; Let’s Plays; commentaryless playthroughs; instruction manuals; physical copies of the games and their original hardware; and as many designer interviews, reviews, speedrun guides, and histories of these games as possible. After this process, we assembled a corpus of 30 games. How we decided what game was part of the chronicle is related to our sampling criteria, inclusion criteria, and method.

5.1 Sampling Criteria

Research like this is often frustrating because no central database of affordances by games exist. As such, historic work on games often begins with a question of, “how long did X exist in games and how has it changed?” The process of answering is essentially a long-winded hunt for specific needles in stacks of other needles. Researchers hunt for games in which X exists through exhaustive web searches, their memories, network sampling, snowball sampling, identifying gameplay videos, and every other tool in the toolkit.

To wit, what occurs when researching games in this manner is a realization that exhaustive representation is simply not possible. As of this writing, the largest database of games, MobyGames, contains over 300,000 games¹². These games encapsulate the whole of videogame history yet, within MobyGames, one will note that the games are heavier with newer systems and slowly become more sparse as you move backward. Additionally, while the number of games is huge, their categories do not lend themselves to this type of work. For example, the use of cues related to ! and ? would find themselves inside of some sort of categorization of schema related to cues for information, MobyGames separates their games by fan-labeled categories (e.g., Genre, Theme, Rating System, Company). Even if games were categorized based on affordances, there would be additional issues related to consistency and usage over time cannot be accounted for in a database easily.

Our sampling criteria is *purposeful* and *not exhaustive*. We rely on *landscape sampling*, in which researchers aim to build a representative sample based on novelty [9]. In this way, as we examine games and find similar games, they are not added to our sample unless they themselves contain a novel version of the affordances we are examining. The approach is similar to that used in prior research deriving design insights from videogames (e.g., [74, 86, 90]). As a result, we have collected usages of ! and ? from videogames spanning decades and have included them here.

¹²The current inventory of MobyGames can be found at <https://www.mobygames.com/stats/>.

5.2 Inclusion Criteria

To be included in a landscape [9], there is a condition of novelty. Yet, in the circumstance of ! and ? usage, every use is novel given the context of the game it appears in. We elected for a number of inclusion and exclusion criteria in order to better focus our sample within those contexts.

Our first criteria was to look for games that included either a ! or a ? as part of the game user interface, but not as part of a statement or speech. For example, a game that indicates to interact with the touch screen by showing “TOUCH!” as part of the user interface would not be included, nor would one in which the character’s dialogue had exclamations or questions, but one in which there is a speech bubble showing only ! would. Second, we looked for the appearance of ! and ? inside of the gameworld [48] itself. For example, if the symbols appeared in background signs as ambiance, we did not include them. Instead, we sought out moments like in *Metal Gear* or *Metal Gear Solid* wherein the ! and ? appear above guards’ heads when they hear something or see something.

The present research aims to assemble a chronicle, looking back to the earliest instances of use. We choose to focus on the platforms in which these instances start: games on personal computer (PC) and consoles. We did not expressly omit games on PC and console that additionally have mobile ports, but we did not seek out mobile games, mobile being a recent phenomena. Likewise, we did not use Virtual Reality (VR), Augmented Reality (AR), or anything related to Extended Reality (XR); while VR has a long history [56], it is only recently acquiring a design language (which is founded in PC and console platforms). We additionally did not include arcade games as their popularity and use tends to pre-date the earliest games of our sample and an in-depth dig did not find any evidence of their usage save that of *Q*bert* [QB], though we used the Intellivision version for the present research¹³.

Finally, when a game series uses ! or ? across multiple games, we use the first game in the series to employ ! or ? (e.g., *Monster Hunter* [MH], *Final Fantasy XIV: A Realm Reborn* [FF14], *Metal Gear* [MG], *Etrian Odyssey IV* [EO4]); if there was a dramatic shift in gameplay or the use of ! or ?, we include other games (e.g., *Metal Gear* [MG] and *Metal Gear Solid* [MGS]).

6 METHOD

As we analyzed our data, we began to notice trends and patterns in the games that used ! and ?. We began to outline what would become gameworld punctuation. In this section, we provide a discussion of this analysis and development of our concept. Our method of analysis is best understood through the tenets of *thematic analysis* [11] – a qualitative approach to identifying connections and themes within a dataset. Our process was:

- (0) Initial Work (not normally an enumerated step): Our previous projects, carried out over the prior five years, have provided insights that drove the data collection for this project, setting up our new concept and theory to initiate this project. We made use of their datasets as a starting point for building the dataset for this project.
- (1) Data Familiarization: We rely on a combination of longtime experience with videogames, discussed possibilities within the group via virtual meetings and the research group’s text chat, and looked to other media for games that matched the inclusion criteria.

¹³This is not to say they do not exist but that we did not find any in the hundreds of games we tried (save *Q*bert*). Interestingly, if this use did not exist in the arcade spaces, then it originates in home consoles and personal computers. An important note is that while we have included an arcade game [QB], we have included the Mattel Intellivision game and have included the dialog box of “?!#?” rather than the arcade box of “@!#?@!” as an automated reaction to the player losing a life. This choice was made due to the shortened dialog and additional uses for ! and ?

- (2) **Generating Initial Codes:** The research team, through virtual meetings and text chat, assembled relevant games into a spreadsheet and described instances of ! and ?, what we would later call gameworld punctuation, in the games. We gathered screenshots, instruction manuals, copies of the games, and sought out discussions of the game where pertinent. In this phase, we also eliminated games that were found not to fit the inclusion criteria.
- (3) **Searching for Themes:** Two of the researchers worked through the descriptions of the use of ! and ? in the data set and identified connections between games.
- (4) **Reviewing Themes:** Throughout the process, the team revisited the spreadsheet, identified higher level connections, and/or eliminated themes that did not fit the data. Each time we ran in to a new game or use for ! and ?, we would discuss it as a theme and as a part of the landscape. In these circumstances, we iterated our sample and thus iterated our chronicle (e.g. we organized and grouped our themes while additionally reviewing and revising our themes).
- (5) **Defining and Naming Themes:** We analyzed the descriptions of the themes, refined these, and named them (as reported in this document). Importantly, the peer review process was able to take part in this coding and asked us to rename our themes, thus becoming accessible for more than just the authors of the present research.
- (6) **Producing the Report:** As the themes coalesced, we arranged them into a chronicle to understand the history, outlining our narrative.

Thematic analysis, like any qualitative method, requires pronounced and easily discernible steps. It is important to note that each of these steps can overlap and when they do, a discussion occurred about it and the team decided how to move forward. Through this method, we organized our landscape in order to encapsulate all of the ways ! and ? had been used in game with just a few games devoted to each portion of the landscape. We ended up with 30 games. An example of what sort of content was the focus of the present work and how many games are in each theme can be found in Table 2.

7 THE LANDSCAPE OF GAMEWORLD PUNCTUATION

We set about to examine the ! and ? in videogames over time. After gathering 30 games and interpreting the ways they used these symbols, we found seven different ways they have been used over the 60+ years our chronicle encapsulates. None of these uses have ever stopped, they are all in active use and have been since originally created. Where appropriate, we offer speculation – based on the data at hand – as to when they appeared. Table 2 describes the themes and associated data; in the remainder of this section, we explain each of the themes in detail.

7.1 PLAYER-USED MARKS

While these are not the first uses of these marks, they do reflect a general myth surrounding the creation of the question mark. For example, it was theorized for quite some time that people drawing maps or looking at maps – in ancient Egyptian time – would write ? on maps to indicate a place that was unknown [43]. This is incorrect because Egyptians (and most languages spoken at the time of ancient Egypt) did not use punctuation at the time, but the general idea for this category is the same. In some games, ! and ? are used by users to mark a map where something may be unknown.

In the *Etrian Odyssey* series, starting from *Etrian Odyssey IV* [EO4], these marks exist as part of a separate mapping system. Within this map system, players are asked to draw maps of dungeons that they are exploring [90]. This is all done manually in the style of old computer role-playing games (CRPGS), wherein the player would record a map of the gameworld on graph paper since

Table 2. Final themes resulting from the analysis of ! and ?. Theme names are provided, along with their description and the list of all games from the dataset that exhibited the theme.

THEME	Description
	Games
PLAYER-USED MARKS	Players are afforded an ability to use marks either in-game or via a game cartography system. <i>Etrian Odyssey IV: Legends of the Titan</i> [EO4], <i>Minesweeper</i> [MS]
AI-USED MARKS	Agents in-game use marks under certain events. <i>Dead Cells</i> [DC], <i>Desperados III</i> [Des3], <i>The Legend of Zelda: Breath of the Wild</i> [LZ:BW], <i>Mario Golf: Super Rush</i> [MGo], <i>Mark of the Ninja</i> [MN], <i>Metal Gear</i> [MG], <i>Metal Gear Solid</i> [MGS], <i>Monster Hunter</i> [MH], <i>Ōkami</i> [Okami], <i>Pokémon Red</i> [P:R], <i>Q*bert</i> [QB]
SOMETHING NEW!	Punctuation to mark information that has been unread. <i>Diablo II</i> [D2], <i>Diablo III</i> [D3], <i>Divinity: Original Sin</i> [D:OS], <i>Final Fantasy XIV: A Realm Reborn</i> [FF14], <i>Nioh</i> [Nioh], <i>Old School RuneScape</i> [OSRS], <i>Professor Layton and the Curious Village</i> [PL1], <i>Stellaris</i> [Stel], <i>The Outer Worlds</i> [TOW], <i>World of Warcraft</i> [WoW], <i>You Must Build a Boat</i> [YMB]
BEHAVIOR CHANGE	Agent behavior will temporarily change due to some event or circumstance. <i>Dwarf Fortress</i> [DF]
AS OBJECT	The ? or ! are used to represent objects in some way. <i>Angband</i> [Ang], <i>Rogue</i> [Rog], <i>XCOM: Enemy Unknown</i> [XC:EU]
REACT!	A real time indicator that the player needs to respond quickly. <i>Dead Cells</i> [DC], <i>Mario Golf: Super Rush</i> [MGo]
NOT VALID	Used to indicate something in-game cannot be validated. <i>Magic: The Gathering Arena</i> [MTG], <i>Stellaris</i> [Stel]

the games did not yet feature automaps [72, 90, 91]. While players can use the marks of ! and ? in any way that they'd like to, many players use them in the way of that old myth, they mark ? where something is unknown, and ! is often used to represent danger or where information embedded in the environment is located.

This style of usage is additionally expressed in *Minesweeper* as demonstrated in Figure 2. Where the *Etrian Odyssey* series calls back to early limitations of memory with its manual mapping affordances [75], *Minesweeper* is much older. The game originated on mainframe systems in the 1960s and 1970s but was popularized when it was bundled with Microsoft's operating systems [53]. In the game, players are presented with a square of varying sizes depending on the difficulty. When a player clicks somewhere on the square, a number of smaller squares are removed and replaced with numbers. Each of the numbers represent the potential for mines to be next to them.



Fig. 2. [MS]::PLAYER-USED MARKS. In *Minesweeper*, players are greeted with a grid of squares that they could be enlarged for greater difficulty [LEFT]. The object of the game is to reveal all the spaces not containing mines. On the player's first click, the game reveals the start of the puzzle with a collection of numbers. The numbers represent how many mines that specific square is touching. Players mark suspected mines with a flag. If they are unsure, users mark it with a question mark [CENTER]. Players do this until they successfully reveal every non-mine space or click on a mine (that detonates and ends the game) [RIGHT].

For example, in a square with a 3 and a 2 next to them means that 2 or 3 mines could be next to those blocks. With this information, the player must determine where the mines could be based on all the numbers. To help them mark these mines, players can right click the squares they believe have mines on them. Doing so produces a ? on that square. While this is little more than cosmetic, it is similar to that of the *Etrian Odyssey* series, it affords users an ability to mark where something of interest may be but unlike [EO4], it is not an option.

Whereas these games are primarily using these symbols to afford users to mark things, its use does not change either symbols' meaning. Instead, ! and ? embodies the meaning of ? uses. Because it has been used this way, the meaning of the symbol is not so much interpreted as it is embedded as an affordance in [MS] though it is interpretable in [EO4].

7.2 AI-USED MARKS

While some games afford using ? and ! manually, designers might employ them to communicate about their gameworlds. Non-player characters (NPCs) are given subroutines that can contain all sorts of behaviors related to the meanings of ! and ?. For example, in *Q*Bert* [QB], when the player dies, the little orange character exclaims, “?!#!” as if cussing at the player, non-diegetically, for their failure. This category of ! and ? usage concerns itself with the ways that users are alerted to a change in automated behaviors. We call this category AI-USED MARKS, as these reactions all originate with NPCs.

The *Metal Gear* [MG, MGS] series is what initially brought us in to the idea that these two symbols are interesting not only for design, but for the history of games. On the MSX computer in Japan, game designer Hideo Kojima took over another person's design and created *Metal Gear* [MG]. In this game, players assume the role of a character – Solid Snake – who sneaks around an island in order to uncover its secrets [99].

As a game, Solid Snake is a human wandering around an environment populated with other humans and animals who will detect him if he breaks their line of sight (LoS). Initially, these LoS are

just straight lines, though, in later versions of the game, guards would gain sophisticated behaviors attached to a cone-based LoS and different stages of behavior. For example, in Figure 3, we see a guard in *Metal Gear* [MG] noticing Snake on the left; the images on the right are from the later game, *Metal Gear Solid* [MGS]. A ? lets the player know that the guards heard or saw something that was not part of their path. An ! means that the player has been discovered and these can be differently colored depending on context. This use seems to originate from comic book symbolism but were re-interpreted for a digital game. In later sequels to *Metal Gear Solid* [MGS], the player can actually shoot the ! or ? and render the guard unconscious – an interesting play on the diegesis of the game.

The last game we discuss is the *Monster Hunter* [MH] franchise. In these games, a play on the fighting game franchises their developer, Capcom, usually makes, has players teaming up to fight massive creatures called wyverns. Gameworld punctuation is used to designate different stages of a wyvern noticing the players (or a distraction).

Wyverns traverse the gameworld as an idle state. If the players set a trap with poisoned meat, the wyvern will land in an area, notice the meat with a ? above its head, and then walk over to the meat and eat it. If the wyvern notices the players, the ? will appear above their head as they walk closer to where the players are. If the players do not run away, the ? turns into a ! and the wyvern is now conscious of the players being on the map. Wyvern behavior switches from passive to active – it is ready to fight.

This use for ! and ? is most directly influenced by comic books from the evidence we discussed in the background. The use of ? to designate a perplexity whereas a ! is used as an exclamation not only calls to the history and meaning of these symbols, but in how their interpretation travels across language and culture. The meaning generated within the contexts described would not be

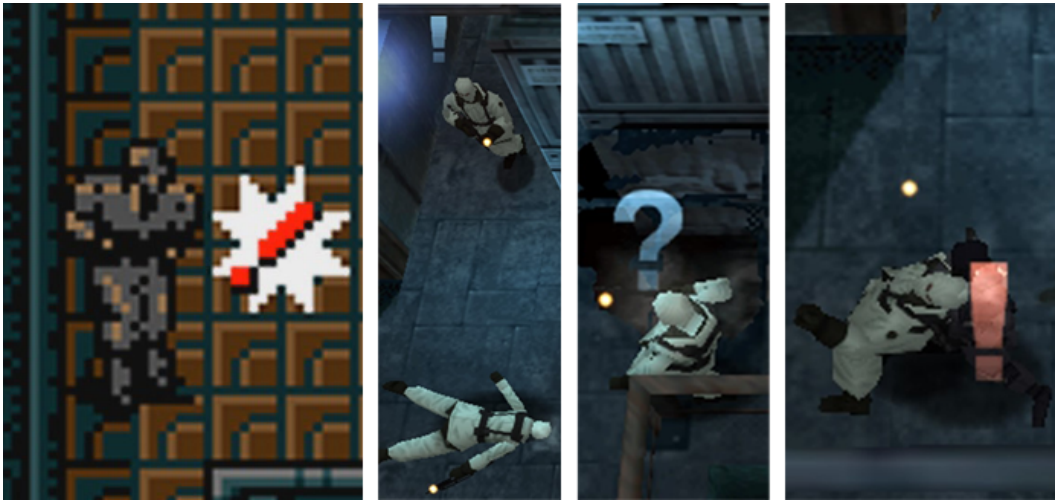


Fig. 3. [MG, MGS]::AI-USED MARKS. In *Metal Gear* if the player breaks the line of sight (LoS) of a non-player character (NPC), an ! appears above the NPC who immediately begins to attack and call for help [LEFT]. In the historically later game, *Metal Gear Solid* [MGS], AI-USED MARKS were used when the NPCs noticed something out of the ordinary, a blue ? appears above their head [CENTER LEFT]. Whereas an NPC looked at 90-degree angles in the original game, NPCs in *Metal Gear Solid* wander around and have a cone-based LoS and when they hear something out of the ordinary, the ? marks their curiosity [CENTER RIGHT]. If the NPCs in [MGS] spotted the player, a red ! appears and the NPC sounds an alarm [RIGHT].



Fig. 4. [FF14]::SOMETHING NEW!. *Final Fantasy 14: A Realm Reborn* uses a variety of symbols to inform the player of about the current state of quests. When a quest is available to a player, it will appear in a shape (designating the type of quest) with a ! within it [LEFT]. In other games, the ? is used to designate that a quest can be completed but in [FF14], an arrow inside a shield is used to inform the player that this is a quest objective [CENTER LEFT]. When a quest can be completed, a check-mark with a green background appears [CENTER RIGHT]. At times, quests require prerequisites (e.g. Level, Fame Value, or current job) and if players do not meet one or more requirements it will display in red with a key symbol attached [RIGHT].

the same if other symbols were used. Or, if there was no reaction at all besides something like a non-diegetic change in soundtrack or enemies changing behavior to storm the player's location. As such, we see designers interpreting the meaning of these symbols, instilling that meaning in-game, and players coming to understand and interpret those behaviors in the same way.

7.3 SOMETHING NEW!

Videogames have become giant, complex machinations filled with an incredible amount of content (generally hundreds of hours per game now, compared to dozens). The scale of gameworlds have grown exponentially with cheaper memory and speedier processors [41, 91]. With such large worlds and large games, there has become a need to indicate to the player when there is *new information*. For the most part, these designers rely on gameworld punctuation to communicate new information. Such new information includes details for a player to review and indicators for quests – small, self-contained stories players complete for resources; the latter was the inspiration for the name of this paper.

In an effort to grab the eye of players for new information, game designers began to place ! and ? in their game user interfaces. For example, *Nioh* places an ! when there are new weapons, armor, or information for the player to digest (see Figure 1). However, this feature seems to have a limit because it is often so pervasive that fans have posted innumerable complaints about it [95]. While this use of ! is increasingly noticeable in games, it is not as noticeable as that of ! and ? in role-playing games.

In *Diablo 2*, the player will occasionally see an ! above the head of certain NPCs, indicating they have a quest for the player. That quest could be central to the narrative of the game or an optional side quest. While the first instance of this we found was in *Diablo 2* [D2], it has expanded and been used in ever more games until it resembled current use cases in *Diablo 3* [D3].

An exemplar of this current use case, is *Final Fantasy XIV* [FF14] (Figure 4). In *Final Fantasy XIV*, players must engage a rich world seeking fame, fortune, and glory. To do this, players must constantly find NPCs that have quests that can help the player gain power. Those quests, seen in Figure 4, take different forms:

- an ! surrounded by a fiery gold circle indicates it is a quest for the central narrative of the game (Figure 4 [LEFT]);
- a red ! in a fiery red circle with a key icon means the quest cannot be taken on yet (Figure 4 [RIGHT]); or
- an ! with a blue circle around it indicates that quest will unlock additional quests, provide regional benefits, and other types of quests.

When the quests are in situ, there are occasions wherein certain NPCs or gameworld areas where there is something necessary to continue the quest. In earlier massively multiplayer games like *World of Warcraft* [WoW], the quest marker moves from a ! to a ? when it is ready to be turned in, or completed by taking a single last step with the NPC marked with the ?. In other games, the information transmitted can vary even more. For example:

- *Stellaris* [Stel]: an ! provides the player with information about certain civilizations having broken a legal agreement;
- *Professor Layton and the Curious Village* [PL1]: the ! shows the player where new puzzles may be found;
- *The Outer Worlds* [TOW]: the ! clues the player in that there are new customizations, skins for weapons, and new weapon attachments;
- *Divinity: Original Sin* [D:OS]: the ! indicates that party members can be spoken to and something gained out of that interaction; and
- *You Must Build a Boat* [YMB]: the player has either new information to read or that they have finished all of the quests available for that area.

7.4 BEHAVIOR CHANGE

Each of these categories, while mutually exclusive, do share a fundamental premise, they communicate information quickly. The BEHAVIOR CHANGE category is unique in that while each provides information, this use affords users an ability to maintain situation awareness for other things happening in the game. *Dwarf Fortress* [DF] is perhaps one of the most important games to be released in the past few decades. This game, unlike most others, does not seek to push on graphical processing, but on logic processing and complexity [93]. In the 1980s and 1990s, computer makers attached graphic cards to motherboards in order to enhance the number of polygons that could be calculated in any given second. Should *Dwarf Fortress* [DF] had been released during that time, a supplemental logic card would perhaps have been added to motherboards and the videogame would act far differently than it has.

Speculation aside, this game is vintage-focused in that it uses ASCII characters to represent everything from Balrogs¹⁴ to zebras. It uses ASCII for visualization as the game uses every ounce of computational power to maintain a vast gameworld with several millennia of procedurally generated history. The player is responsible for taking a group of dwarves and establishing a new fortress. The game requires an immense amount of attention as the initial 7 dwarves expands through a complex simulation of their civilization.

Dwarf Fortress [DF] uses ! and ? as a quick reference to note behavior changes. For example, a light blue ? indicates that a dwarf currently has no job (Figure 5), whereas a red ? indicates

¹⁴Members of Gandalf's race – the Maiar – who were corrupted by Melkor in J.R.R. Tolkien's Middle Earth [19].



Fig. 5. [DF]::BEHAVIOR CHANGE. *Dwarf Fortress* has the player taking control of 7 dwarfs in a world that has thousands of years of procedurally generated history in that world. This is a game devoted to situation awareness as the player must not only explore, but build a fortress and dwarven civilization. As such, the iconography for the game is important to learn. For example, when a dwarf has a ! on them, it signifies a variety of things according to its color. Each dwarf has a job queue and those jobs are listed like that picture on the [LEFT]. At times, dwarves will have moods and consequences of the world around them. In the [CENTER] picture, there are 7 dwarves who have gone insane and 1 dwarf who is melancholy. If a dwarf or other creature does not have a job or anything it is doing, a ? appears in a blue background [RIGHT]; if the creature lacks a destination, the game shows a red ? (not pictured). And this is just the touch of the iconography for what is often called the most complicated game ever made [93]. Note: In these screenshots, the game is running with a graphic tileset rather than the default ASCII graphics.

that a dwarf currently has no destination, indicating problems with activities. Uses of an ! are far more varied, indicating moods, which translate into ways in which the dwarves will behave in the simulation:

- a light green ! indicates that a dwarf is currently in a martial trance or that they are seeking battle;
- a dark red ! indicates that a dwarf is currently enraged;
- a pink ! indicates a dwarf is currently possessed by a spirit; and
- a yellow ! indicates that a dwarf is currently throwing a tantrum.

There are additional moods that dwarves can be in (Figure 5).

In both cases, the use of these punctuation marks calls back to *Dwarf Fortresses*' inspiration from old ASCII games. In addition, it also calls toward hardware limitations in that the game uses so much computational power that even a current high-end PC (as of this writing, an Intel i9 processor with a high-end graphics card) is taxed heavily while running the game.

7.5 AS OBJECT

Whereas other uses and categories afford users either information or ways to monitor the current state of a game, sometimes designers use ! and ? to represent physical objects. In games like *Rogue*, the original games that used ASCII characters to draw a gameworld to the screen (and the inspiration for *Dwarf Fortress*) the ! character was used to represent potions. Different colors of potions, much like the different colors of ! in *Dwarf Fortress*, mean different things.

In *Rogue*, when the game was created there were few ways to process graphics on screen. While the PLATO system had vibrant graphics and formed the foundation of the modern computer game market [22], games like *Rogue* provided examples for what could be done with computer games [15]. *Rogue* is built up of a series of floors, each of which is a 3×3 grid of rooms that are generated according to how the curses programming library worked each time the player accesses that floor

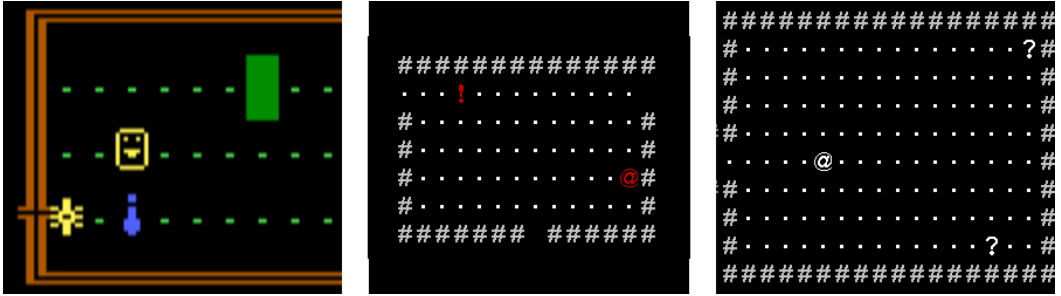


Fig. 6. [Ang, Rog]::OBJECTS. In the game *Rogue* players attempt to make their way through a dungeon, battling monsters and looking for treasures. Occasionally, they come across flasks of various kinds symbolized by `!` [LEFT]. This is also used in another game like [Rog] called *Angband* [Ang] and can be seen in the [CENTER]. In addition to using `!`, [Ang] also uses `?` to represent scrolls [RIGHT] that players can use to cast spells. In addition to [Rog, Ang], [DF] also uses `!` to represent flasks whereas [XC:EU] uses `!` as a gameworld interface icon that lets users know where a bomb is on the battlefield.

[15]. Inside of this grid – the Dungeons of Doom – are creatures guarding the Amulet of Yendor which exists on the lowest level of the Dungeon [15].

Rogue [Rog] completely uses ASCII for graphics, although graphic tileset replacements can be set up in modern versions of it. Within the Dungeons of Doom, the player will encounter `.` representing floor surfaces, `i` representing potions (this is also used in [DF]), and the letters A–Z representing monsters. This usage and the game *Angband* [Ang], despite not being the first game of its kind, fostered the creation of what are now referred to as roguelikes. In these games, letters, numbers, and symbols are used to represent objects. For example, in *Angband* [Ang], a roguelike inspired by the ancient evil stronghold of the same name in Tolkien’s Middle Earth, potions are represented by `!` rather than `i` and additionally uses `?` to represent scrolls. Graphical representation of these can be seen in Figure 6.

Perhaps one of the most famous examples of `?` usage in videogames was released in 1985, *Super Mario Brothers*. In *Super Mario Brothers*, the player takes on the role of Mario, a plumber. Mario’s job is to rescue Princess Peach who is the only one who can restore the Mushroom Kingdom by ending the evil turtle, Bowser’s, spell. This spell made every resident of the Mushroom Kingdom into blocks, plants, and monsters. These blocks take the form of bricks and yellow blocks with a `?` in the middle. These blocks are not themselves tangible objects, but upon hitting those blocks, the soul of a mushroom kingdom resident is released which will give Mario powers or raise the player’s score.

Finally, and more recently, the game *XCOM: Enemy Unknown* sees uses for `!` that resemble that of *Rogue* but are slightly different. In *XCOM: Enemy Unknown*, the player assumes the role of a manager of a squad of soldiers that is meant to fight a sudden and ongoing alien threat. Within the field, the player will sometimes see a `!`. This symbol (it is an icon that floats above it but is still essentially the object itself as the removal of the icon means the bomb is gone) represents a bomb that the player must defuse. So, not only does a `!` or `?` represent SOMETHING NEW!, but a tangible OBJECT as well.

7.6 REACT!

Videogames are often reliant on the intersection of a player’s reaction time with the procedures that test them. At times, the need to insert prompts for players to move is important as it can not only disrupt the flow of a game, but do so in a way that promotes players to pay attention in



Fig. 7. [DC]::REACT!. *Dead Cells* [DC] is a roguelike platforming game where the player slowly amasses power between deaths. In-game, an enemy will show a ! above their head [LEFT]. This indicates that the player needs to dodge or roll through the enemy [CENTER]. The enemy then executes its attack and if the player has rolled, it will miss the player [RIGHT].

different ways. We use the game *Dead Cells* [DC] on this list as it is one of the only games to use ! in this way. An example of this type of play can be found in Figure 7.

These types of prompts are themselves not rare though it would seem using an ! for them is. These prompts are varied. For example, in *Legend of Zelda: Wind Waker*, players are prompted to parry by the action button shown on screen being replaced with a glowing version of that button at the right moment. In the case of a mobile game like *Monster Hunter: Dynamic Hunting*, the player is prompted to move with a firework like symbol on the side of the screen the attack will come from.

Another way this type of use occurs is in prompting the user that chaos is about to occur. In the game *Mario Golf: Super Rush* [MGo] on the Nintendo Switch, the player is shown a bar that represents the normal space required to swing a golf club and maintain the ball's path without slicing or hooking. Outside of this large space, there is a space of red.

This symbol is complicated because while a ! might appear when an enemy is going to attack, the timing of this symbol varies by monster. And this is an innovation for the use of not only this symbol, but system. Multiple monsters can prompt the user that they are about to attack. When this happens, the player must figure out how to escape so many attacks. This use of ! does the opposite of that of BEHAVIOR CHANGE as, instead of offering a quick way to survey all of the working parts of a system, it presents the player with a way to see just how chaotic and precarious their situation is.

If the player presses the swing button as it moves down or up toward those red spaces, an exclamation mark appears. This mark cues the player that not only is the ball going to hook or slice, it will not be predictable. The result is that the ball will go in a random direction; while this is not necessarily the same thing as prompting the user to REACT!, it is prompting the player of the same type of action (something beyond their control) is about to occur and to prepare.

7.7 NOT VALID

Digital games and programming languages lend themselves to design concepts. The way that these languages work has itself been used in videogames. In this case, the ! and ? symbols are often used to indicate something akin to a lack of validation or their mathematical notion of != or “does not equal.” The use of this notation typically comes in the form of validation checks. These validation subroutines will check to see if things like decks (in the case of a digital card game), subscriptions, or even network ping. These uses are similar to that of SOMETHING NEW!, but instead of being a way to immerse players, they are notations that alert the user that they cannot proceed without fixing something.



Fig. 8. [MTG]:NOT VALID. *Magic The Gathering: Arena* [MTG] is an online version of the collectible-card game of the same name. Players buy digital packs of cards, use those cards to make decks, and compete against each other within the rules. If a player creates a deck that does not follow the rules for deck creation, they are greeted with a red triangle featuring a ! [LEFT]. At times, rules for decks change and if the player created a deck previously legal under that ruleset but it is currently not, it will be displayed with a white triangle and exclamation point [CENTER]. This means the deck is playable, but not in the rules that are currently selected. In addition to using ! for NOT VALID, it is additionally used for SOMETHING NEW! to notify players they have unclaimed rewards [RIGHT].

For example, in *Magic the Gathering: Arena* [MTG], a digital version of the collectible card game of the same name, players have to make a deck of cards from their collection given a certain number of rules. Those rules include parameters like, “no more than 4 of any card that is not a land” and “certain cards are banned”, or otherwise restricted. If the players do not have a deck of cards that meets the parameters of a legal deck, it is marked with a ! as “requiring attention.” This can be seen in Figure 8. Whereas these symbols are used in the foreground where a player can see, they are additionally used in the background by developers.

On occasion, these developer-visible indicators are mistakenly made visible to players. In the case of *Call of Duty: Black Ops 2*, the developer accidentally left a server-side flag viewable to players – anyone who did not pay for a certain feature was marked with a !. While this mistake was quickly corrected, innumerable questions and posts on forums and communities devoted to gaming and the games in question were made asking what the symbol meant [5].

8 DISCUSSION

Through thematic analysis, we found seven categories of use for gameworld punctuation, ! and ?, in videogames over their history. These meanings are cyclical and derive from the development of not only videogames but street signs, machine displays, computer languages, and software design. These symbols have been and are continuing to be used for both their physiognomic and programmatic meanings. Through this history, we see these symbols representing objects like potions or mushrooms, new information, as icons for bombs, as a notification to get out of the way, and that a dwarf, somewhere, is lonely, angry, or having a temper tantrum.

How, and what these symbols could mean, why they should be used by future developers seeking to provide better immersion for their gameworld is in need of more discussion. Through SI, researchers can gather a symbol’s meanings and history and we have shown these marks, symbols, glyphs, pictograms, or punctuation marks like these do not lose their meaning over time. The lack of entropy of each of these meanings speaks to how computation has shifted the way meaning is derived from symbols.

In videogames, mediated by computer processors and memory, meanings seem to only widen, not change. Whereas originally, games like *Rogue* used these symbols due to memory issues, their

use in similar ways, despite memory being extremely cheap, now speaks to that stability or lack of entropy.

8.1 Passive, Automated Symbol Consumption & Communication

The use of these symbols provides a significant amount of information with little overhead required. Some games, like *Journey* [63], also do this through their randomly generated symbols that uniquely identify players, a more diegetic approach for that game's setting. This symbol is mapped to a button that allows the player to chirp that symbol and is the only way to communicate with other players. While this button and symbol resemble that of ! and ?, it is not as deep an interaction because players do not have any sort of connection to it during their first entire playthrough.

With the ! and ? gameworld punctuation, the information they generate relies on extant meanings from outside of games. Once the action they ask for is performed, users are brought inside of a gameworld interface. This relationship, this pulling into a gameworld is not only memorable, but useful for designers of different games to pull on. It is useful because it is a mark that exists outside of all other media that retains meaning *any* user will know, regardless of language or culture.

While we show seven ways ! and ? are used, the core of this analysis is that they are present in nearly every way that users can interact with digital games. Even without the inclusion of their use as punctuation, their omnipresent status is unique among those symbols games deploy. In addition, we can say that these symbols show that it is important that existing content from other media can be used to help bring users into a gameworld [49]. Or, to put it more plainly, we can make better software by understanding these moments of overlap between media as we understand users bring experiences from elsewhere into new use scenarios.

By being more purposeful with symbols like these, we can deepen interaction with not only digital games, but make it easier to learn. We suggest this based on an important aspect of SI that persists inside of HCI, that users bring an understanding of symbols and tasks from outside of a piece of software in order to perform tasks with that software [13]. Or to be even more plain, we can use the varied meanings of ! and ? outside of digital environments, even from different media, as an aspect of design that can foster better users.

By examining the ways that symbols like these have been and are currently still being used, we gain unique insight into the overlap of use. More work is needed to tease apart this relationship. For example, we display ! and ? usage and their history within this chronicle. Yet, there is additional potential to expand this symbolic usage not to more symbols, but how interactions that could have used these symbols did not. As mentioned, games like *Monster Hunter: Dynamic Hunting* use prompts like that of the REACT! category for ! and ? uses. The reasons why this change was made from ! and ? to fireworks and the consequences of that change could teach us much in future designs. Much more work is needed to unpack how and why designers shift these marks!

We believe that these two symbols provide a new way to examine games that more closely resembles that of affordance theory [25, 68]. Yet, the use of these two symbols remain firmly entrenched inside of the history of these symbols. We could refer to this as symbolic affordances, those affordances that rely on meanings established in other media. How and why symbols maintain their meaning as they travel across media is itself worthy of study from disparate domains and could prove a unifying force for discipline in this way.

8.2 Complex Ideas Simplified to Essential Components – Uses Beyond Games

The symbols ! and ? have unique meaning among games that derive from their existence as punctuation marks over time. That meaning has combined with the digital environment in games and derived new meanings. Those meanings are stable meaning that other designers, regardless of



Fig. 9. Examples of non-game software using ! to indicate NOT VALID. In Apple's iOS [LEFT], failing to send a message results in the icon badge showing an ! in place of the number of unread messages. In Microsoft's Visual Studio code [RIGHT], a failed server connection results in an error message with an !. In both of these cases, the user needs to restore a network connection to proceed.

genre, type, or audience can use them with the understanding that the people who play the game will understand their uses.

That meaning is not only stable, but often times complex in its capacity. For example, communicating moods of dwarfs in *Dwarf Fortress* [DF] gives the player quick information at a glance like a road sign. Their use in *Dead Cells* [DC] provides the player with the same type of information and prompt for complex behaviors based on the context within the game itself (in this case, that the player should dodge out of the way). As an outsider, these symbols may shift meaning from one of grounding ones self into a game to foreign symbols of a hostile environment. In this way, we can say that the impact of these symbols for those who have not experienced them represents a hurdle.

It is a hurdle because, while the symbol usage communicates complex information quickly, that communication is dependent on the symbols' usage and meanings. And while that meaning is construed by virtue of having learned nearly any language in the world at this point, their uses in games originates with that meaning but shifts slightly. The existence of ! and ? inside of games though, while contextually connected to game history which provides for a variety of moments of confusing sense making, additionally provide an object from outside of games that can provide useful first steps for users learning how a particular game works.

It is worth noting that examples of the use of gameworld punctuation exist outside of games, as well. NOT VALID indicators exist in a number of places in non-game UIs (Figure 9). A failure to send a message in Apple's iOS will add and ! next to the failed message and may update the icon badge to show an ! rather than the usual number of unread messages¹⁵. ! and ? have been used in a number of operating system error messages to indicate to the user that some action needs to be taken or a task has failed. Cataloging such uses may be handy future work, revealing further categories of use (which, in turn, may further influence game design).

We can say that videogames have boiled complex behaviors down to single symbols. They could not have done this without the overlap with comic books, television, and film. As such, these two characters demonstrate the interconnected nature of media and more work should be done to show this overlap, its consequences, and its benefit. As such, we see the influence this genre, and really computer-mediated communication in general, has on stabilizing the uses of symbols. This use requires more sustained effort to understand. And by highlighting these trends, we hope that more work will be done to find other ways to help users understand not only games, but software more generally.

8.3 Meanings Change Over Time, but Games Are a Bit Different

HCI is rarely connected to its history in anything but its paradigms [23, 76]. Yet, these symbols show that history is constantly present in games. Affordances, much like anything else, are things

¹⁵"If you can't send or receive messages on your iPhone, iPad, or iPod Touch" <https://support.apple.com/en-gu/HT204065>.

that change over time. For example, in US and European games, $\times$ is used to negate something and $\circ$ as a way to positively refer to something. Yet, in Japan, $\times$ is used to confirm choices and $\circ$ cancels them.

This small, Sony-PlayStation-focused, example has tremendous impacts on designers who seek to present their product to a diverse cultures. The existence of cultural differences in games, when seen from the lens of capitalism, means that more capital will need to be spent to realize the impact of these differences. And yet, this linguistic difference matters little when symbols like an ! and ?, which originated in Greek and Latin thousands of years ago, have not only maintained their original meaning, but new ones it is used for over time [43].

When these symbols are used, they are encountered by users and translated by previous exposure to those symbols elsewhere. Unlike that of $\times$ and $\circ$ on a Sony PlayStation controller with its varied meaning, the ! and ? are not only used the same way across the languages that use them, but even by languages that are not connected to their creation (e.g. Chinese, Japanese, Korean). More research is needed to find other symbols, other concepts from other media, and other ways cultures connect to each other in this way. By finding these connections, new ways to decrease the hurdles required to overcome figuring out how a product works can be found. While we may have outlined seven distinct meanings for ! and ? over time, this is just a start. The existence of each of these meanings in concurrence means that not only is symbolic interactionism important to games, but that games, or more importantly computation, is important to maintaining a consistency of meaning for symbols like these. The way these symbols are imbued with existing meaning inside of products like games calls to Wiener's *Cybernetics* [100] and how computer-mediated communication stops the entropy of language over time. This shift in meaning and a lack of entropy forces a change to SI as changes to symbols no longer replace previous meanings. That change is primarily that focused on how SI notes that meanings change over time. What the present work shows is that that when computer-mediated communication is occurring, meanings do not change, but widen.

9 CONCLUSION

We understand that everyone uses their experiences to interpret the world and that over time, new experiences may shift what and how things are interpreted. This level of interpretation has, over time, been called a number of things in HCI. For example, at times this concept has been called the paradox of the active user [13], the task-artifact cycle [12], the gap between intent of design and actual use [98], appropriation of technologies [26], user experience design, or user training. The core tenet of this discussion is that there is an unreachable, contradictory, hypocritical, even paradoxical space that no design could reach, let alone engage.

While computation only works in the way that it was written with unintended use cases forming the basis of disagreement, humans do not¹⁶. Through an analysis of just two pieces of punctuation, the present research assembles a whole out of the computer, the human, and the invisible tenets of society that create the previously described HCI phenomena. Interpretation is not simply based on the software, gameworld, or diegetic elements before us. We rely on previous experiences to make sense of the present.

We need signs, signposts, and symbols that will help us connect our past experiences to the present designs. Much like that of literal punctuation, we can say that ! and ? punctuate our designs in terms of objects, actions, content, and potential issues between the gameworld and the player.

¹⁶A unique aspect of this work is that we found ourselves going back to Peter Naur's work, especially "Programming is Theory Building" [65] to consider different forms of software development that focused more on the intent and theories of human activity [66] that their software encapsulates.

To use these in future designs, more work needs to be done to identify other such gameworld punctuation. Or, maybe not *just* gameworlds but software design in general.

The uses of ! and ? in videogames is innocuous, even silly at first. And yet, the rich history of these symbols in languages over time lend themselves to teaching us not only how meanings change over time, but how the interaction between designers, users, and the things designers make not only stabilize meaning, but provide complex communication and contextualization for those things. In examining these uses, it is important to note that overuse, much like that of comics and advertising in the 1960s and 1970s, could diminish the value of these pieces of punctuation. Certainly, given the variety of languages in the world, designers could seek alternatives that players could learn and use in play.

The use of gameworld punctuation as tools of immersion, as tools of communication across culture, as ways for designers to bring their users in quickly, cannot be understated. However, we are only engaging the surface of these uses. More work is needed to tease apart the subtle differences in their use. More work is needed to expand this work to other symbols. For example, in our examination of games for our chronicle, we saw uses for other pieces of punctuation and characters such as: *, <, >, use of color in text boxes, and even brackets in games. How and why these symbols began to be used and their persistence across the history of games may point to a far more pervasive domain of inquiry that unites semantics, gestalt theory, sociology, designers, and users.

Finally, one of the last lessons-learned in this piece is one of information validity and availability. In systematically evaluating the use of gameworld punctuation, perhaps the most frustrating part of work like this can be addressed: a lack of structured data. If game enthusiasts can approach their object of study through this level of detail, game databases like MobyGames could be tapped to host more robust data outside of credits, genre, and platform availability. And through these data, games can connect better to software design generally, intersectionally. And new types of play, more intimately connected to the humans who consume them, can appear.

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