# Have We Left the Paperverse Yet?

## Maps, Boxes, and other Paper Objects as Imaginative Devices of Unfulfilled Desires in Early Gaming

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## AT THE END OF THE PAPERVERSE?

What you saw was not always what you got in the days of early gaming. Disappointment was a common experience for gamers whenever the flashy depictions of game contents as presented in adverts and the limitations of early computer graphics clashed on screen. One of the most striking examples for this was the infamous debacle of E.T. THE EXTRA-TERRESTRIAL (1982). Frequently deemed the worst game ever made and responsible for Atari's decline and the subsequent video game crisis of 1983, this questionable status has been somewhat vindicated in recent years.[1] The realities of non-intuitive gameplay, glitches, awkward controls, and other badly executed aspects aside, one reason for the game's disputed reputation certainly was the large divide between players' expectations, who had seen Steven Spielberg's blockbuster, and the technological limitations of game consoles that did not allow for a similarly captivating and immersive experience. However, such shortcomings alone do not suffice to explain the commercial failure since all early games were restricted by the same technological limitations,

1 Harris, John: "Review Roundup: Was E.T. Really the 'Worst Game Ever'?" in: *Game History Foundation,* https://gamehistory.org/et-atari-reviews-worst-game-ever/, collects several reviews from magazines of the time, concluding that *E.T.* was not considered the worst game of the era, not even of the month of its release, "but with its high licensing cost and failure to perform at the market, it was an easy scapegoat for a console game industry in decline." (Ibid.)

especially when it came to computer graphics that would be reduced to strongly pixelated graphics for a long time. Players usually coped with 'looking past' limitations and filling in the gaps left by limited visual presentations with their own imagination.

Additional materials and media, therefore, were very much sought-after for enriching and invigorating gameplay experience. In this regard, the packaging itself could be very relevant. The cardboard boxes of 'bookcase games,' with their origins in tabletop games, would frequently serve as canvases to paint upon what technological restrictions left to desire. Moreover, they are proof of how much early gaming was imbued in the paper world it had been born into. Notorious publishers, such as Infocom, who will be discussed in more detail further below, met demands for richer experiences by not only offering colorful and artful boxes and manuals but also 'feelies'—tangible objects to expand and enhance sensory dimensions, including patches, brochures, buttons, scratch-and-sniff-cards, and others, many of which, were made of paper.

Contrary to media histories that tend to organize time in clear-cut periods, the introduction of computers did not immediately end the dominance of paper. That is why in his cultural history of paper, Lothar Müller aims to correct Marshall McLuhan's simplifying evaluation of the relevance of paper only in its subservience to the printing press. Manuscript culture did not vaporize in thin air after Gutenberg's revolutionary invention; in fact, it still lives on in niches within our societies.[2] The diachronous linear historical narrative of successive replacement needs more distinction, especially with respect to transition periods like ours, which is why Müller turns back to Harold Innis, who had inspired McLuhan to his central ideas. Innis had defined stone and clay tablets as well as parchment as "heavy" media, while he called paper a "light" medium, as it enables widespread, horizontal communication and thus controlling large territories. In paper, the circulation function supervenes the conservation function, and it, therefore, was extremely important for the rise of modern life; modernity is unthinkable without the introduction of paper in the late Middle Ages:[3]

2 McLuhan, Marshall: *The Gutenberg Galaxy: The Making of Typographic Man*, Toronto, Canada: University of Toronto Press 2002 (1962). Müller, Lothar: *Weisse Magie. Die Epoche des Papiers*, Munich: Carl Hanser 2012, p. 99.

3 Innis, Harold: "Die Eule der Minerva (*Minerva's Owl, 1947*)," in: Barck, Karlheinz (ed.), *Harold A. Innis, Kreuzwege der Kommunikation. Ausgewählte Texte*, Vienna/New York: Springer 1997, pp. 69-94, here p. 87; Havelock, Eric A.: "Harold A. Innis – der Geschichtsphilosoph. Eine Gedenkschrift," in: Barck, Karlheinz (ed.), *Harold A. Innis, Kreuzwege der Kommunikation. Ausgewählte Texte*, Vienna/New York:

"Because everything that matters to us happens on paper. Without paper, we are nothing. We are born, and issued with a birth certificate. We collect more of these certificates at school, and yet another when we marry, and another when we divorce, and buy a house, and when we die. We are born human, but are forever becoming paper, as paper becomes us, our artificial skin. Everything we are is paper: it is the ground of activity, the partner to all our enterprises, the key to our understanding of the past."[4]

Paper is a material foundation of modern life. Following the perspective of material theory, paper and digital media will be foremost discussed in terms of artifacts as material objects. This paves the way for analyzing how games intermediate and organize the interrelationship of human and non-human agents that inform our culture and thus also are necessary preconditions of ludic experiences.[5]

Of course, paper artifacts might feel like they have fallen out of time. Indeed, paper is becoming a rare sight in public life. And so, it is little surprise that paper objects are met with nostalgia, an emotion commercially exploited for the sale of paper toys, paper sculptures, or cut-out sheets for grown-ups. What seems like the "auratic" quality of paper marks the moment of its increasing disappearance.[6] This is no contradiction to what has been said, as media nostalgia is the effect of *perceived* loss, not necessarily of real loss. We may be reminded of the paper-laden

Springer 1997, pp. 14-30. Miodownik, Mark: *Stuff Matters. The Strange Stories of the Marvelous Materials That Shape Our Man-Made World*, New York, NY/London: Penguin 2014, pp. 32-63. As is well-known, Marshall McLuhan had been heavily inspired by Innis's work, and even his famous theorem that "the medium is the message" had been prefigured by the latter's writings. Cf. McLuhan, Marshall: *Understanding Media: The Extensions of Man*, New York/Toronto/London: McGraw-Hill 1964, p. 8.

4 Sansom, Ian: *Paper: An Elegy*, London: Forth Estate 2012, p. xix.

5 Hodder, Ian: *Entangled: An Archaeology of the Relationships between Humans and Things*. Malden, Mass.: Wiley-Blackwell 2012. Latour, Bruno: "On Recalling ANT," in: John Law, John Hassard (eds.), *Actor Network Theory and After*, Oxford: Blackwell 1999, pp. 15-25; Latour, Bruno: *We Have Never Been Modern*, Cambridge, Mass.: Harvard University Press 2002; Latour, Bruno: *Reassembling the Social: An Introduction to Actor-Network-Theory*, Oxford: Oxford University Press 2005; Barad, Karen: *Meeting the Universe Halfway. Quantum Physics and the Entanglement of Matter and Meaning*, Durham/London: Duke University Press 2007; Haraway, Donna J.: *Staying with the Trouble. Making Kin in the Chthulucene*, Durham and London: Duke University Press, 2016.

6 Benjamin, Walter: *The Work of Art in the Age of Mechanical Reproduction*, London: Penguin, 2008.

days of our childhoods, while paper might still be an essential building stone of our everyday lives.

However, there are more positive, more utopian narratives of this loss to tell. For the reduction of paper production and usage has also been propagated as an important global goal for decades in correspondence with the UN Sustainable Development Goals (SDGs), especially "responsible consumption and production."[7] As paper production requires cellulose harvested from trees, the reduction of paper helps to prevent deforestation so that the loss of paper can be framed as something desirable. In fact, the idealized concept of a 'paperless office,' an idea that was already proposed as early as 1975,[8] stems from the desire to create more sustainable work environments by supplementing paper-based methods with digital ones. Given that we mostly use emails for communication today, work with digital documents and try to avoid printing, it is justified to say that we have taken a great leap forward. Mobile photography, electronic paper, speech recognition, and speech synthesis are increasingly replacing the drafting and noting function of paper as well.[9] What is more, there are informational advantages: printed information can become outdated, while computer information can be constantly updated. Also, digital data can be managed within the same environment, whereas printed information requires external means of organization.

Public discourse on digitalization, however, has its blind spots. A still common notion is to perceive digital media as immaterial and digitalization as a process of de-materialization, a view characteristic of the 1990s. Sociologist Volker Grassmuck, for example, demonstrates this tendency when he describes digitalization in terms of loss and absence, of "increasing abstraction and decreasing dimensionality."[10] Referring to Vilém Flusser (1920-1991), he populates the fully digitalized Turing Galaxy with "timeless bodies," "surfaces without depth," and "points

7 United Nations Foundation: "Sustainable Development Goals," https://unfoundation.org/what-we-do/issues/sustainable-development-goals

8 Giuliano, V.E.: "The Office of the Future," in: *Business Week*, June 30, 1975, pp. 48-84.

9 Conrad, Michael A.: "Papierlose Notizen: Zum Gebrauch von Handyfotografie als Mnemotechnik des Alltags," in: Lobin, Henning et al. (eds.), *Lesen, Schreiben, Erzählen. Kommunikative Erzähltechniken im digitalen Zeitalter*, Frankfurt a.M./New York: Campus Verlag 2013, pp. 83-106.

10 Grassmuck, Volker: "Die Turing-Galaxis. Das Universal-Medium als Weltsimulation," in: *Lettre International* 28, 1995, pp. 48-55; my translation, German original: "zunehmender Abstraktion und abnehmender Dimensionalität."

without lines,"[11] a description that finds its climax with the problematic assumption of a "zero-dimensionality of bits."[12]

Yet even though they are not visible to the human eye, bits and bytes are by no means without dimension; they indeed are *res extensa* and, as such, material. The unavoidable material dimension of digital media is exactly the reason why today's public has been discussing more vividly the possible effects the Internet might have on energy consumption and, thereby, on CO2 emissions and climate change. In its Tracking Report for 2021, "Data Centers and Data Transmission Networks," the International Energy Agency IEA states that the need for data services is rising exponentially and that data centers today already account for approximately 1% of global electricity demand. It is thanks to increased energy efficiency that this number is not much higher. In this regard, gaming and streaming services have been identified as the main drivers for boosting the demand for data centers and network services. It is estimated that they will be responsible for up to 87% of consumer Internet traffic in 2022.[13] In their pioneering study entitled "Taming the Energy Use of Gaming Computers,"[14] father-and-son team Evan and Nathaniel Mills have analyzed the global energy consumption by gaming, and it has been estimated that about 75 billion kilowatt-hours of electricity are required for gaming alone worldwide, while U.S. American gamers emit about 12 million tons of carbon dioxide annually.

Energy issues aside, the different devices needed for working with digital media—monitors, batteries, computer mice, data cables, storage media, etc.—are no less physical and must be produced. What makes this worse is that the production is part of large global supply chains, and like all microelectronics, many elements of computers and notebooks require Rare Earth Elements (REE), which are often

11 Ibid.; my translation, German originals: "zeitlosen Körpern," "tiefenlosen Flächen," "linienlosen Punkten."

12 Ibid.

13 International Energy Agency (IEA), George Kamiya: "Data Centers and Data Transmission Networks," Tracking Report Nov 2021, https://www.iea.org/reports/data-centres-and-data-transmission-networks. The often-cited example, according to which each Internet research has a footprint of 0.2g $CO_2$ is not likely to be correct anymore, since Google has made its search engine more energy-efficient by using renewable energy and carbon offsetting, see Griffiths, Sarah: "Smart Guide to Climate Change," https://www.bbc.com/future/article/20200305-why-your-internet-habits-are-not-as-clean-as-you-think

14 Mills, Evan/Mills, Nathaniel: "Taming the Energy Use of Gaming Computers," in: *Energy Efficiency* 9/2, June 2015, pp. 1-18.

mined in countries with very low environmental and social standards. Human rights violations, deforestation, and contamination of land and water, therefore, are side-effects of their mining.[15] Moreover, the handling of electronic waste causes great ecological problems, which is why there have been calls for more eco-friendly recycling. That is why green computing has become an important topic in recent years.[16] Considering the physicality of ICT infrastructure, it thus becomes clear how much gaming does indeed *matter*, not only in the sense of social discourse but very much in ecological terms as well. The possible outcomes of the Anthropocene, therefore, also lie in the responsibilities of gamers. All negative effects notwithstanding, the move toward a more digital world is generally regarded as an important next step away from overbearing resource consumption and waste production, making digitalization a key technology of social transformation.

What one, therefore, must bear in mind is that gaming—also and necessarily—is a *material practice*, a point to be analyzed in more detail with the following examples, which also highlight the interdependency of paper and digitality in early gaming from the 1980s till the early 1990s. More than that, they clarify how deeply computer technology and gaming are rooted in paper culture. Far from proposing any linear model, it will show how paper is becoming more and more obsolete for digital gaming, a point that will underscore how much the history of digitalization so far has also been told as a history of emancipation from its overbearing forefather, paper.

The concentration on material practice and the relationships between humans and non-human actors prompts basing the analysis on Bruno Latour's Actor-Network-Theory (ANT) and other posthumanist theories, such as those offered by Donna Haraway or Karen Barad, as well as Ian Hodder's entanglement concept.[17] Yet a central leading thought comes again from Grassmuck, who ascertained that

15 Barros, Óscar et al.: "Recovery of Rare Earth Elements from Wastewater Towards a Circular Economy," in: *Molecules* 24/6, March 13, 2019, p. 1005. Rim, Kyung Take/Koo, Kwon Ho/Park, Jung Sun: "Toxicological Evaluations of Rare Earths and Their Health Impacts to Workers: A Literature Review," in: *Safety and Health at Work* 4/1, 2013, pp. 12-26.

16 Considerations of the ecological impact of computing actually has a longer history already, starting in the late 1980s, but the issue certainly has created more public awareness in recent years. See, e.g., Ahmad, Ishfag/Ranka, Sanjay: *Handbook of Energy-Aware and Green Computing,* Boca Raton, FL: CRC Press 2012.

17 I. Hodder: Entangled. D. Harraway: *Staying with the Trouble*; B. Latour: *We Have Never Been Modern*.

the materiality of (storage) media is capable of prescribing their usage: "Every phase of media rests on specific basic elements, the sign material, and its materiality, which itself enables characteristic operation, e.g., forms of storage or of making connections."[18] In assemblages of paper and computer technology, as they are of interest here, this implies that they can both similarly prescribe gaming experience. Instead of pretending that material and digital worlds belong to separate storylines, it is necessary to stress that they share a common history in which they pose as collaborative and co-creative partners. Focusing on paper will allow us to surpass media histories that assume strong breaks and will instead offer a sensitivity for longer cultural developments in which the appearance of computer games finds itself enmeshed. In turn, the enormous historic significance of paper for enabling new games and toys, as well as new ways of play, will become much clearer.

To focus on materiality does not mean to imply that there aren't, in fact, aspects of games—both analog and digital—that could be described as immaterial. Rules, for instance, are something that is usually considered essential for anything that is to pass as a game. Even in spite of Ludwig Wittgenstein's important assessment that the plethora of phenomena we tend to subsume under the linguistic label of 'games' is basically inexhaustible and can therefore not be given any general definition to cover all, the existence of a set of rules is something that even he presupposed as the lowest common denominator, although one can, of course, debate how crucial they really are for games and if we could actually think of games without rules. What can be agreed upon, though, is that in games, rules do not always have to be defined explicitly to be in effect.[19] But while rules may have material correlations, they share a widely media-independent existence and can thus be expressed in different medial forms. What is more, the verbalization of rules alone is usually not sufficient to convey their meaning; instead, we often need assemblages of different media to explain rules to others, often with a blend of 'show and tell,' words, gestures, and physical demonstrations:

18 V. Grassmuck: "Die Turing-Galaxis," p. 48; my translation, German original: "Jede Phase der Medien beruht auf bestimmten Grundelementen, dem Zeichenmaterial und seiner Materialität, die wiederum charakteristische Operationen, z. B. Formen der Speicherung oder Verknüpfung, zulassen."

19 Wittgenstein, Ludwig: *Philosophische Untersuchungen*, Frankfurt am Main: Suhrkamp 1977, esp. §66; Macho, Thomas: "'Es schaut uns doch an'. Zur physiognomischen Metaphorik in Wittgensteins Aufzeichnungen," in: Arnswald, Ulrich/Kertscher, Jens/ Kroß, Matthias (eds.), *Wittgenstein und die Metapher*, Berlin: Parerga 2004, pp. 253-268.

"The code of a computer game is not the exact same thing as its rules. The computer code is part of the medium that embodies the game, just like the written-out rules of Chutes and Ladders are embodied in the medium of printed ink on paper. But as with the rules of a non-digital game, in which aspects of the rules can be hidden 'under the hood' on the constitutive level, or pass unspoken on the implicit level, the rules of a digital game take a number of different forms. This means that although there is some overlap between the code of a game program and the rules of the game that the program makes possible, there is not a one-to-one correspondence between them."[20]

Given its crucial role as a building block of modernity, in the following, I will explore in more detail the diachronous history of paper and gaming. For that purpose, I will first turn to the Middle Ages, when paper was first introduced to Europe, and so the paper world we know today was formed. It is also here that we are going to find the first alliances of games and paper, a connection that then becomes similarly important for early computer technology that, as a short analysis of Alan Turing's ideas on the universal machine will show, was not only born into a paper world but grew out of it and stayed attached to it for the longest time of its existence. The drafting function of paper, for which the blank sheet has literally become a synonym for the process of brainstorming (and an empty, impartial mind), is no less still crucial for game design as the brief analysis of the history of the creation and aesthetics of accompanying materials of MYSTERY HOUSE by Roberta Williams will show, which today is often considered the first graphic adventure. Paper and computer remained co-creative allies for quite some time, which the examples of the (now mostly lost) cultural technique of hand-drawn computer maps and the supplement of paper objects to give early games additional sensory qualities demonstrate. Altogether, the various examples show how much we should consider the medial identity of early games as open and fluid, material-immaterial hybrids—a point returned to and elaborated more a last time in the conclusion.

## THE DEVELOPMENT OF THE FIRST PAPER GAMES IN THE LATE MIDDLE AGES

The use of paper for gaming purposes more or less coincides with its increasing presence in Europe. It seems that, time and again, the appearance of new media

20 Salen, Katie/Zimmermann, Eric: *The Rules of Play. Game Design Fundamentals*, Cambridge/London: MIT Press 2004, p. 142.

quickly spurs impulses to explore how it could be used for games. A reason certainly lies in the proximity between research and gaming itself, as both are actions devoted to the exploration of the possible. In turn, this might help explain why the game industry can be a driver of innovation, which is true not only for the age of the computer but also for the age of paper.

We cannot determine with absolute precision when exactly the first paper mills were established in Europe, but they are already testified for medieval Andalusia. What is more, the increased mention and appearance of playing cards, which belong to the first game objects made from paper we know, coincides with the intensification of paper production in Europe during the first half of the 14th century. Since most relevant records on the early history of card games are, in fact, prohibitions in legal codes of Italian cities, it seems justified to assume that they had already existed for a while before they became a public nuisance.[21] Like with other games, prohibitions had little effect on the demand for playing cards, which was constantly high and made the development of new production technologies necessary, with one result being the improvement of woodcut print. This meant it was no longer required to handcraft and hand-paint cards; from now on, it was possible to mass-produce them mechanically, so that within a short time, cards ranged among the most frequently produced printed commodities in all of Europe.

Another printed game-like good in German-speaking regions were the so-called *Losbücher*, divinatory books created for entertainment purposes, or at least that was what their, often anonymous, authors claimed. The books offered collections of short prophecies, usually in rhymes, that readers could pick by applying a method of sortilege, usually the casting of dice or the picking of cards to determine the valid forecast. The application of game objects was quite common, which is why some books use dice or cards as a system to order their prophecies. The integration of principles of chance turned these books into an interactive experience. At least in one case, the anonymous *Tierlosbuch* (which translates as *The Animal Book of Lots*) printed by publisher Martin Flach in Basel in 1485, the book came with its own integrated randomization device: A volvelle, a small paper disk that could be spun like a roulette wheel.[22] It was segmented, with each segment

21 Conrad, Michael A.: "Randomization in Paper: Shuffling as a Material Practice with Moral Implications in the Late Middle Ages and Early Modern World," in: Classen, Albrecht (ed.), *Pleasure and Leisure in the Middle Ages and Early Modern Age*, Berlin/Boston: De Gruyter 2019, pp. 539-582.

22 Crupi, Gianfranco: "Volvelles of Knowledge. Origin and Development of an Instrument of Scientific Imagination (13th-17th centuries)," in: *JLIS—Italian Journal of Library, Archives and Information Science* 10/2, 2019, pp. 1-27.

carrying the name of an animal that referred to one of the divinatory poems. The animal chosen by the wheel revealed the right poem to look up in the book.[23]

The connection between rotary motion and luck, and thus of life in general, has a long history. Its most famous manifestation certainly is the trope of the Wheel of Fortune, the *rota fortunae*, as portrayed by Boethius (ca. 477-524) in his dialogue with Goddess Fortuna in *De consolatione pilosophiae* (523 AD). The most famous depiction certainly is from the *Carmina Burana* manuscript at Bayerische Staatsbibliothek in Munich. However, the trope of a cyclical form of contingency persists until today—not just in roulette but also in board games such as GAME OF LIFE: With each turn of an integrated wheel of fortune, players follow the stages of an idealized western life from graduation till pension, with the—very obviously capitalist—goal of trying to accumulate as much money as possible. The game was based on a much earlier one called THE CHECKERED GAME OF LIFE developed by the company's namesake, the lithographer Milton Bradley, who modeled it after the traditional GAME OF THE GOOSE.[24] The paper technology of the medieval volvelle has been continued as well and re-employed for coding and decoding. One famous example is the code wheel ("Dial-A-Pirate") for THE SECRET OF MONKEY ISLAND, intended as DRM and copy protection. The game could only be played when users replicated a combination on the screen with the code wheel and entered the resulting code. However, this protection method was far from perfect since users could xerox the original and thus tinker together their own code wheel copies.[25]

## ENDLESS PAPER: ALAN TURING AND THE COMPUTER

Yet the relationship between paper and digital media goes much deeper than these few examples of game design techniques might suggest. First conceptualized by Alan Turing (1912-1954), the idea of the computer as a universal machine is deeply rooted in paper technology. One must bear in mind, though, that this universal machine, as described in *On Computable Numbers* (1936), is, first of all, a

23 Conrad, Michael A. (ed.): "Tierlosbuch," in: Heiles, Marco/Reich, Björn/Standke, Matthias (ed.), *Gedruckte deutsche Losbücher des 15. und 16. Jahrhunderts*, Stuttgart: Hirzel 2021, pp. 31-86.

24 Strouhal, Ernst: "Die Welt im Spiel—Panoramablick," in: Strouhal, Ernst, *Die Welt im Spiel. Atlas der spielbaren Landkarten*, Vienna: Brandstätter 2015, pp. 7-15.

25 As, for instance, mentioned by user "drym" on January 24, 2021, in a forum about vintage games, https://www.kultboy.com/index.php?site=t&id=2573&s=1&st=3

thought experiment and cannot be actually built.[26] Whereas its main faculty consists in being able to perform all possible types of calculations, its basic mechanism is astonishingly simple: a read/write head moves along an infinite "tape (the analog of paper)" that is segmented into an equally infinite number of sections ("squares"). Each of these squares carries either a symbol taken from a defined set of symbols or is empty. The machine can only scan one square at a time. At any given time, it has one of a finite set of internal states. A table (its 'program') tells the machine what it must do when it finds a certain symbol on the tape while having a certain internal state. The actions of the machine are limited to moving one square left or right, writing a symbol onto the tape, shifting into a different internal state, or halting. Yet by these simple means, any kind of computational operation can be performed.

Turing is very clear in emphasizing that his main point of comparison are humans that, at his time, performed computational acts which, as he notes, were "normally done by writing certain symbols on paper." Employing human computers for doing complex calculations was, back then, still a widespread profession. But even more interesting is that Turing explicitly introduces paper as the material reference point of his thought experiment, even though he, at an early stage in his essay, clarifies that this tape does not have to be proper paper but "the analogue of paper." The operations he describes, therefore, are, at least to some extent, media-independent. Accordingly, he continues:

> "We may suppose this paper is divided into squares like a child's arithmetic book. In elementary arithmetic the two-dimensional character of the paper is sometimes used. But such a use is always avoidable, and I think that it will be agreed that the two-dimensional character of paper is no essential of computation. I assume then that the computation is carried out on one-dimensional paper, i.e. on a tape divided into squares."[27]

While admitting that computation was usually carried out on the flat surface of paper, Turing hastens to add that he does not regard this as a quality essential for the correct performance of arithmetic operations. A "one-dimensional" paper, he says, would suffice. Yet on closer inspection, this is something quite unimaginable and, in fact, even paradoxical since a square necessarily lives in the realm of two-dimensionality. To make things worse, real paper is actually three-dimensional,

26 Turing, Alan M.: "On Computable Numbers, with an Application to the Entscheidungsproblem," in: *Proceedings of the London Mathematical Society* 2, 1937 (received 1936), pp. 230-265.

27 A. Turing: "On Computable Numbers," p. 251.

so any talk of two-dimensional paper is a mere abstraction. But since his universal machine is an abstract idea, it is absolutely clear why Turing does not need to assume the properties of concrete paper, neither its feel nor its color or transience (which brings us back to recycling and temporal cyclicity). And still, the mere idea of a writeable surface cannot be completely detached from the properties of paper or the conventions of its use. By relating back to the haptics of pen and paper, Turing designs his universal machine as something more than just an abstract-mathematical object.[28] Naturally, this does not affect the general objective of his argumentation of wanting to demonstrate that no machine can be constructed that could prove with certainty that any proposition *A* is provable.[29] Moreover, it does not need any further debate that infinity cannot be realized within the restrictions of finite resources, and so the infinite tape or paper stripe it would need to construct a true Turing machine can never be implemented, not even in silicon, since even all the sand in the world is, in the end, limited. Therefore, any existing computer can be nothing more than an approximation of Turing's ideal.

As a person of his time, Turing lived within a very vivid paperverse, a world wherein paper was a key facilitator of life, which is why the idea of a paper tape as the carrier of information came so naturally to him. The ubiquity of paper as a resource is also reflected in that punched paper was an early means for recording and storing data for microcomputers, such as the *Altair 8800* (MITS, 1974), when datasets and floppy disks were already around. Punched cards based on stiffened paper—which was, by the way, already in use in the late Middle Ages for the creation of paper cards—represented digital data by the presence or absence of punched holes. The technology was rooted in much older ones developed in the 18th century for conserving and transferring information for controlling looms (and weave patterns). While Basile Bouchon is credited as one of the first to have automatized a loom by punching holes in paper tape, it was Herman Hollerith (1860-1929) who used this technology for recording data that could be read by a

28 Dotzler, Bernhard J.: "A.M.T. (1936): Husserl, Wittgenstein, Musil, Fleck und Turing," in: Dotzler, Bernhard J., *Diskurs und Medium III. Philologische Untersuchungen: Medien und Wissen in literaturgeschichtlichen Beispielen*, Munich: Wilhelm Fink 2011, pp. 249-261, here p. 254; Warnke, Martin: *Das Medium in Turings Maschine,* in: Warnke, Martin/Coy, Wolfgang/Tholen, Georg Christoph (eds.), *HyperKult. Geschichte, Theorie und Kontext digitaler Medien*, Basel/Frankfurt a.M.: Stroemfeld 1997, pp. 69-82.

29 Enzensberger, Hand Magnus: "A.M.T. (1912-1954)," in: Enzensberger, Hans Magnus, *Mausoleum. Siebenunddreißig Balladen aus der Geschichte des Fortschritts*, Frankfurt a.M.: Suhrkamp 1975, p. 113.

tabulating machine.[30] Yet even in a more general sense, the organization and storage of data in computers have tight ties to paper technologies, especially file cabinets and index cards as invented by Carl Linnaeus (1707-1778) in ca. 1760. If seen in the light of Turing's abstract ideas, the central functionalities of paper have never really left the computer. Even today, algorithms consist of written lines in a formalized language saved as text files—and we are not even considering here the notes and drafts a programmer might pen down on paper to design his program.

## PAPER PROTOTYPES IN GAME DESIGN

But the paperverse not only informs computer games on this very fundamental level. Paper is still an indispensable intermediary for drafting and designing games. A famous case is MYSTERY HOUSE, developed by game design pioneer Roberta Williams (*1953) and today credited as the first graphic adventure game. Williams had been inspired to create her game after having played COLOSSAL CAVE ADVENTURE, the world's first text adventure game, which she had found underwhelming, as well as Agatha Christie's murder mystery novel *And Then There Were None* and the board game CLUE, which helped her to break away from the narrative linearity of the novel. And so, she decided to create *Mystery House* as an interactive murder mystery: while in the beginning, players search for jewels hidden in a Victorian house, throughout the game, they discover the corpses of several persons and therefore have to find out which one of the guests is the murderer before they become their next victim.

For the implementation of the project, Roberta collaborated with her husband, Ken Williams (*1954), who took care of the coding. Given what they perceived as the flaws of text adventures, the couple decided to integrate graphical scenes that would make the game more engaging. For this purpose, Roberta Williams drew seventy scenes, first onto paper, which were then converted to digital images by means of a contraption for the Apple II called a VersaWriter. This tablet allowed for hand-tracing paper drawings with an optical arm. A resulting problem, however, was storage size since the seventy images would not fit into a regular 5¼-inch floppy disk. Ken solved this issue by converting the images into coordinates and coding instructions so that the computer would redraw the scenes in action, which is something players can still observe on-screen: every image is built up in real-time, line for line.

30 Krajewski, Markus: *Paper Machines. About Cards & Catalogs, 1548-1929*, Cambridge, MA/London: The MIT Press 2011.

Together with her husband, Roberta had founded On-Line Systems (1979), which, after its rebranding as Sierra On-Line, would become one of the most important and influential studios for early computer games, with important releases including the KING'S QUEST (1983-1998), POLICE QUEST (1987-1998), SPACE QUEST (1986-1995), and LEISURE SUIT LARRY series (1987-ca. 2008).[31] MYSTERY HOUSE itself would become part of a series of six adventures called *Hi-Res Adventures* that were published between 1980 and 1982. In 1996, Sierra was bought by CUC International and dissolved in 2008. Roberta retired from the game industry soon after, in 1999.[32] That is, until recently. For on March 22, 2022, during the annual Game Developers Conference held in San Francisco, Roberta and her husband announced that being isolated at home because of the Covid-19 pandemic, they had become so bored that they decided to create and publish a new game—called COLOSSAL GAME ADVENTURE 3-D, based on the aforementioned game of the same name to which they owed much of their career.[33]

While it might seem little surprising that Roberta first drew the rooms of MYSTERY HOUSE out on paper, this is a recommended practice for game design even today. A textbook from 2012 still suggests the use of paper for creating game prototypes, even in spite of today's achievements in software and hardware technology, in fact, because of them, since "software prototypes are relatively slow and expensive to create."[34] In their now classic seminal book on game design, *The Rules of Play*, Katie Salen and Eric Zimmerman similarly refer to paper as an

31 The LEISURE SUIT LARRY series is being continued still, even after Sierra was shut down in 2008.

32 Fish, Charlie: *The History of Video Games*, Barnsley, South Yorkshire, UK/Havertown, PA: Pen and Sword Books 2021, pp. 44-46. Levy, Steven: "The Wizard and the Princess," in: Levy, Steven, *Hackers: Heroes of the Computer Revolution —25th Anniversary Edition*, Sebastopol, CA: O'Reilly 2010, pp. 241-260. See also Roberta Williams's homepage at https://www.sierragamers.com/roberta-williams

33 Andy Chalk, "Sierra founders got 'bored' in lockdown so they're making their first new game in more than 20 years," in: PC Gamer, March 21, 2022, https://www.pcgamer.com/sierra-founders-got-bored-in-lockdown-so-theyre-making-their-first-new-game-in-more-than-20-years/. Also see the video of an interview with both during the GDC 2022, https://www.youtube.com/watch?v=25U6B4lupNM

34 Adams, Ernest/Dormans, Joris: "Paper Prototyping," in: Adams, Ernest/Dormans, Joris, *Game Mechanics. Advanced Game Design*, Berkeley, CA: New Riders Games 2012, pp. 17-19, here p. 17. Exercises in Moore, Michael: *Basics of Game Design*, Boca Raton, FL: CRC Press 2016, pp. 83-86, also make mention of the use of paper for prototyping or pinning down the draft of a game.

important medium for creators to draft or test their ideas: "Early prototypes are not pretty. They might be paper versions of a digital game, a single-player version of a networked experience, hand-scrawled board and pieces for a strategy war-game, or a butt-ugly interactive mock-up with placeholder artwork."[35] This is possible because "some game mechanics are media-independent," just as much as the execution of the infinite tape in Turing's machine does not necessarily depend on the properties of real paper. Comparably, ludic structures have a life of their own and do not under all circumstances require a digital environment to prosper. This does not imply immateriality but simply that the physical specifics are, at least in many cases, secondary.

Advantages of paper prototyping are that it is cheap, can be implemented rather quickly since it does not need additional coding, and is "inherently customizable."[36] Moreover, with a simple paper prototype, the impact of rule changes can be explored in the process of gaming itself.[37] That said, with it come disadvantages, too: "It is more difficult to involve test players, and not all mechanics translate to board games easily." What is more, a computerized game system also takes care of a lot of the game management needed to turn the game into a smooth and continuous experience, for instance, the updating of points or the spawning of enemies. While some of these mechanics could, at least in general, be executed on paper, the gaming experience can become cumbersome—a point that is also interesting to reflect as it marks the fluent border where the thrill of gameplay might turn into tedious work; which might also be part of the reason why very complex board games tend to be unpopular. Computer games, on the other hand, allow for more complexity since a great part of the menial management is automated and takes place 'under the hood,' thus not directly interfering with the experience.[38]

## THE LIMITATIONS OF EXPERIENCE AND MOORE'S LAW

While paper has always been a crucial means to conserve and transmit knowledge—in the form of manuscripts, books, post-its, and even for early computing—it was also a medium to surpass the modal restraints of early computer games,

35 K. Salen, E. Zimmermann: *The Rules of Play*, pp. 12, 16.

36 See the chapter "Paper Prototyping," in: E. Adams, J. Dormans, *Game Mechanics*, pp. 17-19, esp. p. 18.

37 Ibid., p. 19.

38 K. Salen/E. Zimmermann: *The Rules of Play*, p. 142.

especially in terms of graphics. To illustrate these limitations, it is helpful to remember that datasets could not store more than 100 KB each, and the Memorex 650, an early floppy disk, about 175 KB. By 1987, however, the newly released 5¼-inch minifloppy was already capable of storing about 1 million bytes (not the exact equivalent of 1 MB). Lastly, the CD-ROM, when its technical standard was introduced in 1983 by Philips and Sony, offered the then mind-blowing capacity of 553 MB.

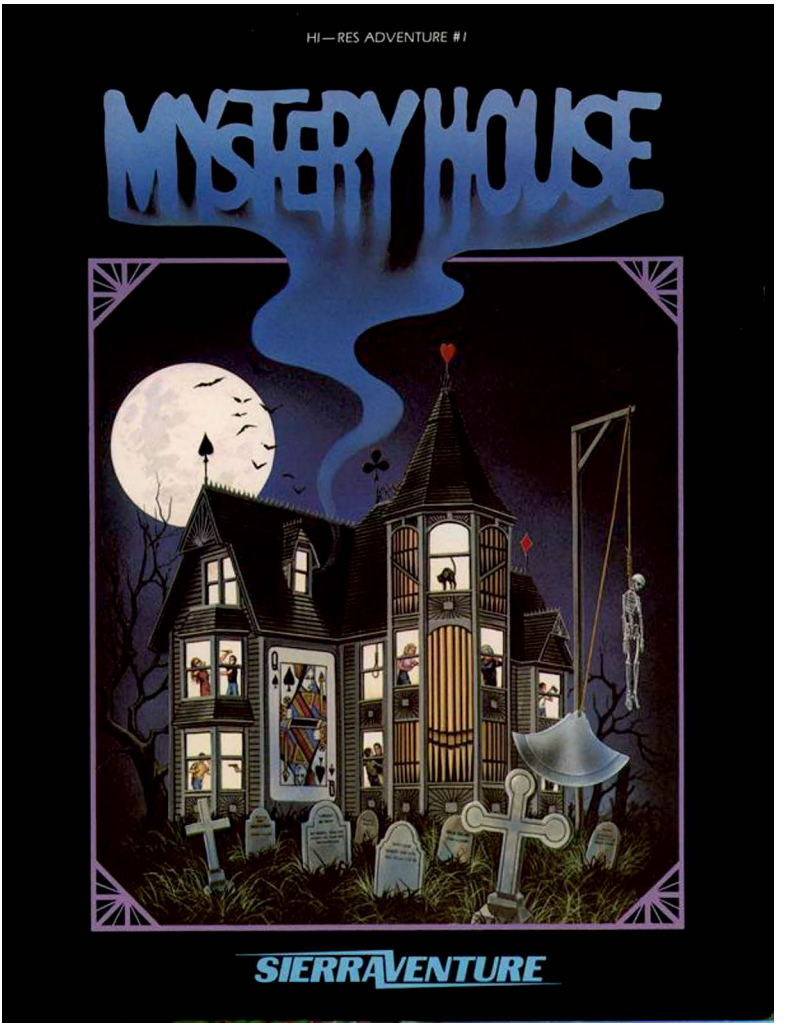
In parallel, the processing power grew enormously, in beat with what has been called "Moore's Law," a misleading term since it is actually little more than a predictive extrapolation based on past trends introduced by Gordon Moore (*1929), co-founder of Fairchild Semiconductors and later CEO of Intel, stating that the number of transistors in a dense integrated circuit would double every two years.[39] This prediction has guided the semiconductor industry as an ideal goal ever since, although the process has been slowing down recently, with today's transistor counts ranging between 39.54 and 57 billion. Accordingly, the Apple II (introduced in 1977), onto which Roberta and Ken Williams had programmed MYSTERY HOUSE, possessed a RAM of only 4 kB that could be extended up to 64 kB—the capacity with which the Commodore 64 (1982) was already equipped when it left the factories, while today's standard of working memories lies between 16 and 32 GB.

Hence, the possibilities to offer players highly immersive experiences in the 1980s were still very limited. But necessity is the mother of invention, and so both players and producers sought strategies to compensate for what they felt games were lacking, and, again, it was paper that saved the day. Cover art was one way to offer users more than what they could see on screen. While it is, of course, true that cover art is a marketing tool, it was, then, also a way to give game worlds more (visual) detail, more flavor than was possible on screen. To illustrate this, we may again tend to MYSTERY HOUSE and the cover art for its re-release in 1982, which is often found on Internet pages discussing the game, even though it is not the original cover art. The image was printed onto a black sleeve that accompanied the floppy disk and is much more detailed than the cover art of earlier releases of the game.

At first glance, the style reminds of pulp magazines or the covers of 1960s exploitation magazines. The scene is set at night and dominated by a Victorian House, the main site of the game.

39 Moore, Gordon: "Cramming More Components onto Integrated Circuits," in: *Electronics* 38/8, 1965, pp. 114-117. Moore corrected this early prediction again in 1975.

*Figure 1: The Cover Art for the Re-Release of MYSTERY HOUSE (1982)*




Source: Wikimedia

The four suit symbols of playing cards (hearts, diamonds, clubs, spades) decorate the rooftops, and there is a large Queen of Spades fixed onto one wall. The reference to playing cards might be considered an allusion to games in general, but also to the mystery atmosphere (a murderer who hides his identity behind a poker face). There are also Halloween clichés: a flock of flying bats against a full moon, a graveyard in front of the house with eight light-colored gravestones

in high grass, with six of them carrying unreadable texts—this, of course, a reference to the murders happening in the house. To the right, there are gallows with a hanging skeleton and a razor-sharp swinging blade, the latter obviously an allusion to the murderous torture instrument of Edgar Allan Poe's *The Pit and the Pendulum* (1842). It might indeed be late autumn since the trees surrounding the house are all bare, with their branches pointing upwards like bony fingers. There even are acoustic markers: organ pipes are on display as wall elements, with the deeply droning instrument belonging to the regular repertoire of mystery movie stereotypes. That said, within the lighted windows, we see different scenes of violence, including a rogue hanging from the ceiling, a man in a black shirt ready to stab a woman, a gun being pointed at a person in a yellow shirt, and people wrestling. Lastly, in one window, we see a black cat arching its back—again a symbol of danger, mystery, even madness and magic, to intensify the gloomy atmosphere.

For the first release of the game, Roberta and Ken Williams had added only a green flyer on light blue paper to the floppy disk that advertised the game starting, a bit nerdy, with a dictionary definition of 'adventure':

> "What is an adventure game? According to the dictionary, an adventure is a hazardous or daring enterprise; to risk, hazard, to venture on. One who goes on an adventure is a venturer. A seeker of fortune in daring enterprises; a speculator. In essence, an adventure game is a fantasy world where you are transported, via your computer. You are the key character of the fantasy as you travel through a land the likes of which you will find in books that take you, through your imagination, to the world it is creating."

The text then sets forth by explaining what players of this particular game are to expect: to solve a murder mystery in which "your friends are being murdered one by one," which is why you must find the killer before he finds you. For the second release, they included a flyer of green paper with the black print of a detailed Victorian House next to a barren tree, but without all the other flashy details. The texts are mostly the same, albeit with a few modifications. By the time of the game's re-release in 1982, the authors apparently felt they no longer needed to give lengthy explanations of the concept of graphic adventure games. Instead, they included a more atmospheric flavor text in the present tense that throws players/readers right into the action to build suspense: "As you near the front yard of the large, old Victorian house, you feel an unexplainable tension […]."[40]

Reading accompanying texts or manuals for games is, of course, no mandatory action, and one reason for the frustrations experienced by players of E.T. had been

40 Scans of all cover art are available at http://sierrachest.com

that they had not. Had they read the instructions, they might have better understood what the confusing symbols on-screen meant and how they helped to master the game. Today, it is regarded as a standard that games have an onboarding strategy or offer in-game tutorials to make sure that players will understand all mechanics. Early games such as MYSTERY HOUSE came without tutorials, which is why the inclusion of printed materials was much more important, as printed texts and images would compensate for the absence of rich details in the game. Handbooks, manuals, and other forms of accompanying objects, therefore, should not be regarded as something external but as partners of a co-creative experience within a multi-modal and multi-medial network. However, there is one important distinction to be made: while official images and texts (and other props, for that matter) help authors and producers control reception, players are not bound to these suggestions and can explore the possibilities of a game world more freely, for instance by creating fan fiction on paper (although fan communities might still decide on what is to be considered canonical and what not).

## NO GAME IS AN ISLAND: MAPPING

Maps belong to the group of paper artifacts that demonstrate how much individual appropriation and adaptation can overlap. Mapping by hand was an indispensable method in early gaming since games did not come with in-game maps or minimaps on a shared screen as they do today. Especially text adventures, such as COLOSSAL CAVE ADVENTURE, or graphic adventures that included labyrinths, such as QUEST FOR GLORY II, required players to map out the alignment of rooms since it was otherwise impossible to keep track and find your way. One of the few alternatives was to hope that in an upcoming issue of a gaming magazine, a map would be provided for the game played that was either offered by the editors or players from members of the reader's community.

As such, self-drawn maps are mnemonic devices that not only help players to orient themselves spatially but also offer a canvas for portraying how they want to remember their experience, which is why some of these maps do not chart the game world accurately but are instead crafted to fit the player's own expectations and desires. To put it differently: Individualized maps constitute ways to reconnect with a past and therefore do not always require accuracy as much as they require *authenticity*. In this regard, they are historical documents that cannot only tell us something about DIY culture in the digital age but also about how players experience game worlds and what they hope to find within.

With today's in-game maps, the practice of mapping, of course, has become mostly obsolete. However, there has been a small revival recently, with pages on the Internet dedicated to self-drawn game maps, mostly for reasons of nostalgia. On his blog, blogger Jeremy Parish, for example, revisited the old practice and applied it himself, thereby noting that after having drawn every detail in the rooms of METAL GEAR, he can now "glance at a section of map and recall precisely what's in that space and how to slip through it." He expresses how much more he feels connected to the game world than he did before, "in a way that doesn't happen a lot with games that feature an auto-map."[41] What stands out in his description is that the practice made him slow down gameplay and look at the rooms more consciously. While he would have otherwise just passed through great sections of the game, he now experiences a much more intimate relation to the virtual spaces provided.

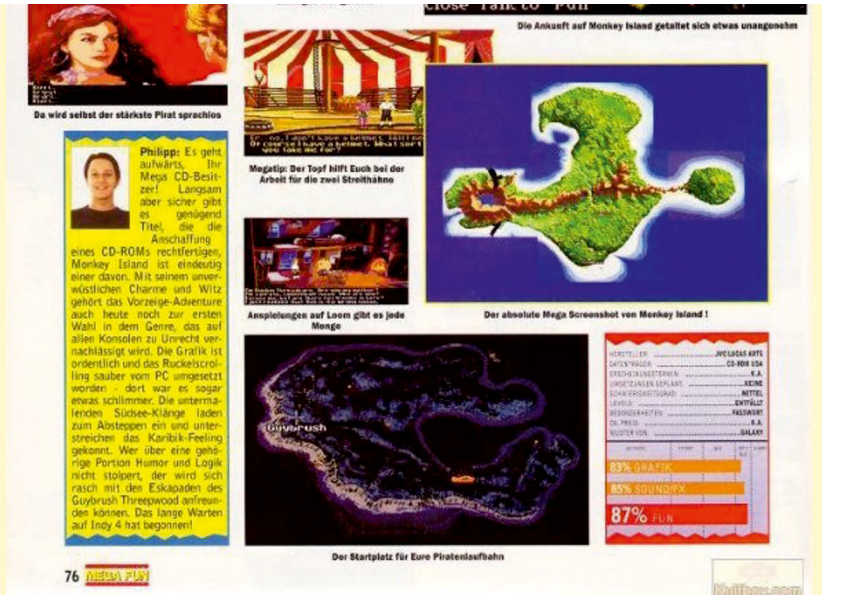
To turn visuality into manual movement apparently is a way to raise awareness of visual events and memorize them. *Ex negativo*, the general absence of manual mapping indicates just how often rooms in computer games are nowadays encountered as mere transitional spaces not intended to be remembered. To make memorable spaces is the exception, not the rule. Oblivion seems more the standard mode in which space is experienced in games, especially in action-rich first-person shooters, where there is high time pressure. There are some exceptions to be found in those well-elaborated spaces that invite players to take their time for exploration and long stays or are part of impressive cut scenes. The repetitive hallway of P.T. comes to mind, or the elaborate designs of some of the awe-inspiring rooms in the relaunched WOLFENSTEIN series with their weird dystopic nostalgia. These spaces are memorable, especially for their emotional values, resulting in more intimate attachment.[42] In comparison, while redrawing game visuals today might seem more like an unnecessary medial 'detour' that breaks with immersion and flow, it also is a practice of making a game world one's own, of anchoring it more steadily in one's identity. The manual practice of drawing turns visuality into a more holistic, bodily experience, into embodied knowledge. That is not to say that gaming is not always—also—a bodily experience, which it is, of course. But it does imply that the transfer into a different modality allows for a more

41 Parish, Jeremy: "Rediscovering the (Mostly) Lost Art of Mapping," in: *RETRONAUTS,* https://retronauts.com/article/437/rediscovering-the-mostly-lost-art-of-mapping

42 Norman, Donald A.: *Emotional Design: Why We Love (Or Hate) Everyday Things*, New York: Basic Books 2004.

intimate and conscious connection by employing the anthropologically important axis of eye and hand, instead of images just rushing by like adrenaline streams.[43]

*Figure 2: Screenshots of Islands from THE SECRET OF MONKEY ISLAND (1990)*




Source: Weidner, Martin/Noak, Philipp: "The Secret of Monkey Island," in: *Mega Fun 2*, 1994, p. 76.

Since every act of individual imitation comes with divergence, with the creation of difference, any act of appropriation is always also an act of adaptation. That said, any hand-drawn map will show at least some kind of difference in comparison to the original. But it can, of course, be a much more conscious choice to diverge from the original and offer a unique interpretation. The island maps of the MONKEY ISLAND series belong to game images that have seemingly occupied the imagination of many players, not least since these games belong to the most popular and successful of their generation.[44] And the saga does not seem to end, given that another game, RETURN TO MONKEY ISLAND, has been announced for 2022.

43 Polanyi, Michael: *The Tacit Dimension*, Chicago, IL: University of Chicago Press 2013.

44 THE SECRET OF MONKEY ISLAND, MONKEY ISLAND 2: LECHUCK'S REVENGE (LucasArts 1991, O: Shelley Day), THE CURSE OF MONKEY ISLAND (LucasArts 1997, O:

These maps are also noteworthy because they enabled the transition between different rooms, which, apparently, seemed a remarkable innovation back then; judging from that it is explicitly highlighted in several reviews of contemporary game magazines.[45] However, this mechanic did not age very well, given that the sluggishness of protagonist Guybrush Ulysses Threepwood trudging along the islands can become a very unnerving experience for today's players. While browsing through Google's image search, several examples of self-drawn maps from *Monkey Island* can be found. A map of Melee Island, a main site of THE SECRET OF MONKEY ISLAND, is, for instance, displayed on *Mapstalgia*, an online project curated by Josh Millard, for which people were asked to contribute drawings of game maps from their memory.[46] According to his own statement, the author of this particular map had not revisited the original before pinning down his very detailed map, which makes the result all the more impressive, although he admits that he did portray the island as angled in the opposite direction to the original.

Another example, a very lavish drawing of a "Skull Island," is inspired by game maps in general and does indeed show the outline of a skull, along with different locations. The series' third installment, THE CURSE OF MONKEY ISLAND (1997), does, in fact, include an island of that same name, but it does not convey the sites mentioned in the imaginary map; moreover, its outline does not resemble a skull. Still, even imaginary maps like this one evidence how much pirate movie clichés have become a common part of collective memory, as has the MONKEY ISLAND series itself.[47]

Map design furthermore lies at the heart of any game design, as it establishes the general framework for all other elements, especially the alignment and content of levels. This way, the map preconditions for any actions that can possibly occur within the world; the visuals also set the game's overall tone. That does not mean

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Larry Aheim and Jonathan Ackley), ESCAPE FROM MONKEY ISLAND (LucasArts 2000, O: Sean Clark and Michael Stemmle), TALES OF MONKEY ISLAND (Telltale Games 2009, O: Mark Darin, Mike Stemmle, Chuck Jordan et al.).

45 Weidner, Martin/Noak, Philipp: "The Secret of Monkey Island," in: *Mega Fun* 2, 1994, p. 76; Lenhardt, Heinrich: "The Secret of Monkey Island," in: *Power Play* 1, 1991, pp. 42-43.

46 Millard, Josh: "Mapstalgia: Video Game Maps Drawn from Memory," https://mapstalgia.tumblr.com/page/48

47 Lindström, Pär: "Skull Island," "Mapping Worlds. Maps of Imaginary Worlds," https://mappingworlds.wordpress.com/2014/04/08/volcano-island Ekaputra, Hans: "Map of Skull Island," https://hansekaputra.artstation.com/projects/xoP2

that the relationship between map and experience is a one-way road. Maps do not determine all action in a strict sense, but their designs do rule what *affordances* will exist within a game environment, that is, what actions are possible within. Action possibilities within an environment directly stem from the relation between user and object, and the design of a space structures this relationship.[48]

*Figure 3: Hans Ekaputra, "Skull Island."*


Source: https://hansekaputra.artstation.com/projects/xoP2

## THE INFOCOM ERA OF "FEELIES"

The example of Intercom's game boxes is intended to furthermore illustrate how paper objects and other props were consciously introduced to enrich the overall experience in early gaming. Infocom was a software company founded by MIT students on June 22, 1979, and is mostly known for its high-quality and award-winning text adventures, but the company also tried to branch out to business applications with a relational database for MS-DOS called *Cornerstone* (1985), i.e.,

48 Gibson, James J.: *The Ecological Approach to Visual Perception*, Boston, MA: Houghton Mifflin 1979, esp. pp. 127-137, here p. 127.

a database that was able to store data in tabular form. Although well-received by critics, *Cornerstone* turned out to be a commercial flop. Financial difficulties then forced the company to agree to a merger with Activision in 1986, which shut Infocom down for good in 1989.

Like Roberta Williams, Infocom game designers Marc Blank and Dave Lebling had been inspired by the COLOSSAL CAVE ADVENTURE. Their efforts resulted in ZORK, which was to become the starting point for a games series, with an original trilogy (ZORK II: THE Wizard OF FROBOZZ 1981, ZORK III: THE DUNGEON MASTER 1982) and later additions (BEYOND ZORK: THE COCONUT OF QUENDOR, 1987, ZORK ZERO: THE REVENGE OF MEGABOZ, 1988). ZORK: THE UNDISCOVERED UNDERGROUND was released way after the company's dissolvement, in 1997.[49] In contrast to other text adventures, Infocom's parser was more sophisticated and able to process longer sentences and sequences. The early games used a derivative of the programing language MDL (Model Development Language), which, too, had been developed at MIT and called ZIL (Zork Implementation Language). ZIL ran on a virtual machine named the Z-machine. Throughout its existence, Infocom would manage to develop more than 40 games, many of them very successful.

Maybe little surprising for a text-based game, Infocom's largest target group consisted of people who liked to read, which was a major reason why their games were also sold at bookstores; also, their main audience tended to possess expensive computer systems and thus belonged to a social segment that was willing to pay more for a good game.[50] What made their products so appealing were their marketing strategies, the vivid storytelling, and the addition of 'feelies,' which was the name they had given props they added to the well-designed game boxes. These feelies usually followed the games' themes, thereby adding to their attractivity. For instance, Infocom's game version of Douglas Adams's THE HITCHHIKER'S GUIDE TO THE GALAXY (1984) came with a special "No Panic!" button, "Microscopic Space Fleet," a piece of fluff, "Destruct orders for your home and planet" cards, and "Joo Janta 200 Super-Chromatic Peril-Sensitive Sunglasses," with which "you'll look cool and stay cool even when attending a Vogon poetry reading!"[51]

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49 For more information on *Zork I*, see Mott, Tony: *1001 Video Games You Must Play Before You Die*, London: Quintessence 2011.

50 See the interview with the two developers, Joel Berez and Marc Blank: Ferrell, Keith: "Interactive Text in an Animated Age: Infocom Faces the Challenge," in: *Compute!* January, 1988, pp. 17-20, here p. 17.

51 See the accompanying booklet to the game box. Briceño, Hector et al.: "Down From the Top of Its Game: The Story of Infocom, Inc.," http://web.mit.edu/6.933/www/Fall 2000/infocom/; Keller, Daniel: "Reading and Playing: What Makes Interactive

*Figure 4: Examples of Gadgets from Infocom's THE HITCHHIKER'S GUIDE TO THE GALAXY (1984)*


Source: The Infocom Gallery, https://gallery.guetech.org/index.html

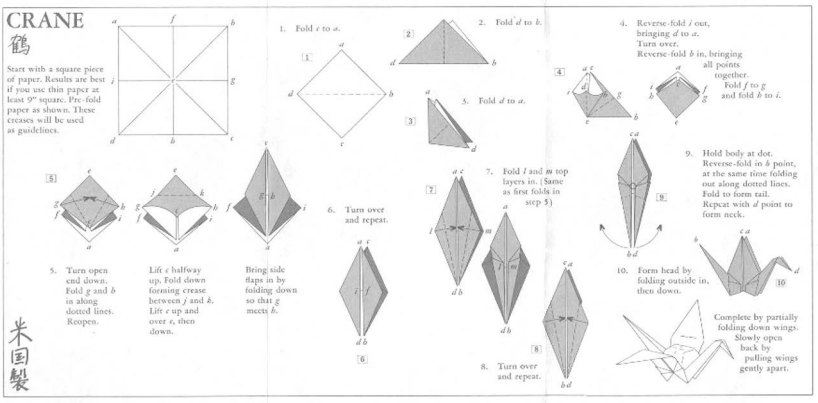
Apart from offering tongue-in-cheek gadgets that would build and intensify customer relations, a practical purpose of feelies was to serve as copy protection against copyright infringement. Some in-game puzzles could only be solved with them, but since they blended so well into the game world, they were not considered intrusive or disruptive. In fact, their haptic character extended the game world into the non-ludic reality. To make all elements fit the overall concept was a general artistic approach and trademark of Infocom. Therefore, in-game puzzles were similarly guided by the logics of storytelling and did not appear randomly. Mapping was an unavoidable necessity when playing Infocom games since the different rooms could only be accessed by writing compass directions into the command line (e.g., "Go West"). No visualization of the spatial dimensions was provided.

Paper could even star more prominently in Infocom's world. Their adventure TRINITY (Infocom 1985, O: Infocom) dealt with some of the darker and more serious matters of the time, reflecting the constant atmosphere of nuclear threat during the Cold War. Its title alludes to the infamous Trinity Site in New Mexico, where on July 16, 1945, the first detonation of a nuclear weapon took place as part

Fiction Unique," in: Williams, J. Patrick/Heide Smith, Jonas (eds.), *The Players' Realm: Studies on the Culture of Video Games and Gaming*, Jefferson, NC: McFarland 2006, pp. 276-298, esp. p. 281.

of the Manhattan Project. In the game, the protagonist flees London at the beginning of World War III, when Russian nuclear missiles are just about to hit the city, through a mysterious portal that transports him to different historical and fictional sites for creating and testing nuclear bombs. Being Infocom's most ambitious project, the game box contained a detailed manual, a short comic book called *The Illustrated Story of the Atom Bomb*, a cardboard sundial with symbols that represent the different sites to be visited in the game, as well as an instruction on how to fold an origami crane (*orizuro*) using the so-called Yoshizawa–Randlett diagramming system, along with a small piece of origami paper to create the origami crane.[52]

*Figure 5: Instruction for Folding Paper Cranes from TRINITY (1985)*




*Source: The Infocom Gallery, https://gallery.guetech.org/index.html*

The origami obviously is a reference to Sadako Sasaki (1943-1955), who had survived the atomic bombing of Hiroshima at the age of two and would live on for another ten years. Legend has it that during her short life, she folded more than one thousand origami cranes—a story that turned the paper object into a symbol of world peace in Japan.[53]

52 For the contents of *Trinity* and *Zork*, see Mott, Tony: *1001 Video Games You Must Play Before You Die*, London: Quintessence 2011.

53 See chapter "Infocom" in Wolf, Mark J. P.: *Encyclopedia of Video Games: The Culture, Technology, and Art of Gaming*, Santa Barbara: Greenwood 2021, pp. 511-514. For scans of the contents of Infocom's game boxes see the Infocom Gallery, https://gallery.guetech.org/index.html

## CONCLUSION

All things considered, paper obviously was an indispensable, co-creative collaborator in early gaming. The significance of the three-partite human-paper-computer-relationship can only be overlooked if one feels seduced by a tendency that identifies the virtual and digital with the immaterial, a notion ensnared in the modernist trap that Bruno Latour, so poignantly, has described as "purification."[54] In practice, things are messier, and we cannot fully separate the digital world from the paperverse it was born into. Early gaming was a necessarily hybrid endeavor and based on a thing ecology that included paper as an important 'ally' of gaming experiences, as one of the "important element[s] for understanding affection and emotion" in gameplay;[55] a place it holds as the preferred matter of choice for mass-produced games and toys since the late Middle Ages.[56] In fact, paper and cardboard are still the most frequently used resources for creating tabletop games.[57] The identity of early games was thus open and fluid, as it would necessarily have to rely on non-digital media to offer users a more holistic and satisfying experience.

But what about now? Have we left the paperverse yet? Generally, there is little doubt that paper is receding. In Germany, the production of paper for printing and writing purposes has decreased by 32% within the last ten years.[58] A main reason for this decline is the computer, although the possibility to print anything anytime from any desk at first created a paradox: from 1980 to 2000, the worldwide use of office paper more than doubled, but has, since then, decreased. According to the US Environmental Protection Agency (EPA), in 2018, 67,390 U.S. tons of paper were generated (in 2000: 87,740 U.S. tons), with 45,970 U.S. tons being recycled (i.e., 68,21%).[59] Yet even more important for the perception of paper disappearing

54 B. Latour: *We Have Never Been Modern*.

55 Sicart, Miguel: *Play Matters*, Cambridge, MA/London: MIT Press 2014, p. 46.

56 Ibid., pp. 43-44. Ian Hodder makes a strong case for the relationships between humans and things and how they shape the dependency or constraints that are defining characteristics of contingent human experience, see I. Hodder: *Entangled.*

57 Conrad: "Randomization in Paper," Clüver: "Würfel, Karten und Bretter."

58 Statistisches Bundesamt (Federal Statistical Office of Germany): "Rohstoffe zur Papierherstellung im Jahr 2021 deutlich verteuert," press release N065, November 3, 2021, https://www.destatis.de/DE/Presse/Pressemitteilungen/2021/11/PD21_N065_51.html

59 U.S. Environmental Protection Agency (EPA): "Paper and Paperboard: Material-Specific Data," https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/paper-and-paperboard-material-specific-data

from social life than the big picture is that within our personal work and domestic environments, paper is indeed becoming sparser and sparser. Instead of getting our information from books and newspapers, we visit digital versions of print media. With electronic paper becoming more common, even taking notes and sketching drafts is going to emancipate itself from paper and circulate within the same digital sphere as all other digital tools used for further processing, such as graphic and word processing software.

While this might primarily affect game design, gaming has also shifted towards a reality where it remains within the borders of the digital, without any need for integrating analog media into the meshes of its network. In the near future, there will be even fewer transitional points between the digital and non-digital, thus making gaming experiences more seamless and less disruptive. The introduction of video game digital distribution services, particularly Steam (Valve), in September 2003, was a real game-changer, as it allows its clients to download games and updates to their computer directly via the Internet, which became possible due to the improvement of bandwidth capabilities. Moreover, Steam provides community features and, with Steamworks, offers a built-in application programming interface (API) that developers can use to create and distribute user-created content. In an interview with the e-zine *Rock, Paper, Shotgun*, Gabe Newell, the president of Valve, described how digital distribution services have changed game creation as well: now, decision-makers can take higher risks since "we can put something up on Steam, deliver it to people all around the world, make changes." [60] The establishment of online communities also makes it easier to raise awareness for smaller games and distribute mods. Lastly, digital distribution has the potential to be more eco-friendly since it makes the resource-intensive creation of physical storage unnecessary and thereby reduces waste.[61]

However, digitalization is a double-edged sword. Privacy issues are one challenging aspect, as is guaranteeing format compatibility over long periods of time

60 Walker, John: "RPS Exclusive: Gabe Newell Interview," in: *Rock, Paper, Shotgun*, Nov 21, 2007, https://www.rockpapershotgun.com/rps-exclusive-gabe-newell-interview

61 Abraham, Benjamin J.: "The Carbon Footprint of Games Distribution," in: Benjamin J. Abraham, *Digital Games after Climate Change,* Cham, Switzerland: Palgrave Macmillan 2022, pp. 123-148; Kerr, Aphra: "The Circulation Games: Shifting Production Logics and Circulation Moments in the Digital Games Industry," in: Paul McDonald/Courtney Brannon Donoghue/Timothy Havens (eds.), *Digital Media Distribution. Portals, Platforms, Pipelines*, New York, NY: New York University Press 2021, pp. 107-125.

so that data remains readable even when storage systems change, while digital storage cannot always ensure the same longevity as paper archives. Also, paper has different affordances than digital documents; the sound of pens scratching on the roughness of its surface, its inexhaustible practical potential—from folding it up to tearing it apart, the triggered combination of eye and hand—all of this might actually be quite crucial for the process of shaping new ideas.[62] Moreover, as has been pointed out in the discussion of Alan Turing, the central properties of paper are inevitably intertwined with the working of computers so that, in an abstract sense, paper will never leave the digital world and always stay its co-creative partner. And indeed, they both share a common world of flatness and superficiality. In the digital world, paper will live on, albeit without its material body.

While there are good reasons to assume that not all paper technologies and practices will ever vanish from public life completely, there might also be good reasons to assume that paper could be disappearing from gaming for good—with maybe the exceptions of conscious revisits and revivals of paper-computer-hybrid methods, for nostalgic or other reasons—gamers, not all, but certain groups thereof will continue to want to experience game worlds in material, more sensual forms, so that they may circulate and interact with other physical objects. At least in this regard, games will keep a medially open identity. As results of hybrid practices oscillating between the material and immaterial, reception and (re-)production, game-related paper artifacts will continue to represent externalized manifestations of their creators' desires and projections. An emerging danger of paper becoming more absent could be that gaming then becomes more superficial, less conscious, and even more short-lived, but perhaps exactly this would make a good case for the importance of scholarly reflection and the demand for more general education in games literacy?

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