EPISODE 1 Part 3: How games die

Some games are dead or dying.[1] *horror scream* But, we can still save many of them or bring back others to life. So get your Phoenix Downs or start casting your resurrection spells. *intro fade in song* Let's go! *intro fade out*

Hello and welcome to Deadplay, a podcast on videogame preservation and analysis! My name is Dany Guay-Belanger, and I'll be your host. Last time, we talked about what constitutes a game, and how there are so many different things that contribute to how we understand videogames. Today, we move on to investigate how games die.

Come on, games don't die. Digital stuff can't die.

I'm sorry to say, but you are wrong. The media housing videogames, and the digital material composing them, actually degrade. In fact, every medium has a different lifespan. Magnetic media – like floppy disks, diskettes, magnetic tapes, hard drives – lasts 10 to 30 years.[2] The lifespan of optical disc media, like CDs and DVDs, is still unknown.[3] Erasable Programmable Read-Only Memory (or EPROM) cartridges are said to last upward of 25 years.[4] And the exact lifespan of Read-Only Memory (or ROM) cartridges' lifespan is still unknown, but there's reason to believe that they might outlive the copyrights of what's on them.[5] Now, these are all estimates, and many factors can impact the lifespan of these media. Sometimes, they can even last longer.[6]

There are many issues when it comes to preservation of what's called born-digital material which needs to be addressed before we pack our bags and go home. Every type of medium used to house videogames, and software more generally, has issues. This is known as "Media Decay" or "Bit Rot", which is defined as "the gradual and natural decay of digital information and storage media over time, causing information to become unreadable."[7] Every type of media is affected differently, and can decay in their own way.

I get that they degrade, but do they really rot?

Well it's not rotting per se. For magnetic media, like diskettes, the magnetic properties of disks 'fade' over time, the signal become weaker and reading them becomes more difficult.[8] This pretty much means that the more time goes on, the more difficult it is to read and access the data on diskettes, and, eventually, it simply becomes impossible. I could get really technical and go into a lot details,[9] but I don't think this is the place. So, I suggest going on deadplay.net and find a link to the Software Preservation Society's website; it's a great resource for this type of issue. In any case, Bit Rot "can be caused by both natural environmental effects, or simply the magnetic corrosion of the media."[10]

In the case of optical disc media – like CDs and DVDs – the reflective layer of the disc can be either physically or chemically destroyed. This causes pits on the disc's surface, sometimes called "CD rot" or "laser rot", but also the discoloration of the disc, and that's know as CD bronzing.[11] ROM and EPROM cartridges share the common issue of data loss when their battery fails, because they use Random-Access Memory (or RAM) chips. The thing is these chips delete data once they lose power.[12] But ROM and EPROM cartridges also differ. ROM cartridges have a longer lifespan, but can still corrode from contact with moisture and battery acid, and their battery can die.[13] EPROM cartridges, however, are not as stable. They store information by charging electrons inside the chip, which will slowly leak through the chip insulation" and that'll cause "irretrievable loss of information."[14]

Well we just have to copy the data on these media and save it somewhere else. *sound of victory/success* *disk scratch*

Nope. Doing that would be incredibly wasteful and impractical. Are we going to have to play a game of cat and mouse forever? Are we going to have to be constantly wary of the level of

degradation of the medium data is saved on? That's not a viable solution. Plus, it doesn't solve other issues. Every time a file is duplicated or copied, it can degrade and runs the risk of becoming corrupted.[15] Also, when new formats, operating systems, and new machines emerge, older ones become obsolete. Now, there are fairly stable ones, like PDF, but it is still proprietary. What if Adobe, PDF's developer, disappears and a new format replaces it? What if Adobe decides to prevent some people from using PDF? Or changes it and makes it no longer as good? We need long-lasting formats.

This is even more important since archives, museums, and other heritage institutions are digitising material, but also because a lot of what we use is now inherently digital. We have to recognise the ephemeral nature of digital media and formats, and the fact that they're much less stable than paper-based ones.[16] The decay of original storage media and data effectively leads to the death of software, and more to the point, videogames.

What if we reached out to videogame creators? They must have copies of their games.

Sometimes, but there's a lack of corporate histories for software producers. A lot of them tend to throw away development material or get rid of their source code to make place for the new products they're developing.[17] We're losing precious development material as we speak. This is especially problematic for source code, because there's little original code available for study.[18] Code writers leave in-code comments like those you can find in the margins of books, for instance.[19] Scholars and heritage professionals have to build relationships with software and videogame creators to preserve the cultural heritage that is still available.

Ok well that sucks for what's lost, but for the documents and code that were kept, you just have to secure the rights to the games! *Victory song + disk scratch*

sigh Nope. Unfortunately, copyright laws actually make it difficult for heritage institutions to preserve videogames for a variety of reasons. First, copyright laws vary across the world.[20] Second, sometimes, many companies work on a single title. This means that while one company published or developed a game, there might be several copyright holders. For example, if the company holding on to the rights for the music of a game doesn't want to give permission, the entire thing falls through. This happened with the Art of Videogames exhibit at the Museum of Modern Art in New York, when they couldn't get the rights for the soundtrack of Goldeneye 007.[21] Third, sometimes, companies ask for onerous fees, making it impossible to acquire the rights for a game.[22] And that's when they don't outright refuse or ignore requests.[23] Not to mention when copyright holders have simply vanished and there's no one to get the rights from![24]

Correct me if I'm wrong, but there are emulated games. How does anyone create an emulation? Aren't they illegal? A museum wouldn't want anything illegal, right?

Well emulation isn't really illegal. It falls in a legal gray zone. In Canada, circumventing digital locks is illegal, except if it's to make sure a computer program works on another computer system or platform. Canadian law is unclear if that exception also applies for collection management; so museums, archives, etc.[25] In the U.S., there's exceptions under the Digital Millennium Copyright Act, or DMCA, but they are only put in temporarily for three years.[26] At the time I am recording this, the next set of exceptions is set to expire in 2018.[27] But this is even assuming we manage to crack and copy the videogames we want to preserve.

What do you mean by cracking?

Cracking is when people modify software to get rid of or deactivate things in it that they don't want, like copy protection.

And let me guess, cracking games is actually quite hard.

Nowadays it is. Videogames are notorious for the large underground economy that plagued creators. Especially during the early years of videogames, it was very easy to copy games and trade them illegally.[28] After all, for a long time, many game producers even recommended creating backups of diskettes. Because of this, many videogame producers started to come up with interesting ways to prevent unauthorised copying. John Aycock, author of the book *Retrogame Archeology: Exploring Old Computer Games*, describes at length three methods of copy protection based on what he calls "what you know", "what you have", and "what you are".[29]

The first, "what you know", is fairly simple; it includes passwords and registration codes that unlock the full functionality of games.[30] These two methods are used especially with shareware software, which is a type of proprietary software initially provided for free to users.

The second two methods are much more extensive. The "what you have" method includes challenging players to find words in the player's manual, like in King's Quest IV (1988); or giving away "Feelies" along with the game. For example, *The Spy's Adventure in Europe* came with a map, Y*ar's Revenge* came with a comic book, and *Deadline* came with evidence packages. Another way was to give what's called lensolk. Basically, you needed to hold a device, that had vertically-aligned plastic prisms, "against the screen to reveal the secret distorted code displayed by the software."[31] There were also code wheels, which challenged players to form words or symbols.[32] And, finally, there were dongles. They're devices that plug "in to one of the computer's ports."[33] "The theory behind basic dongles is that resistors or other circuitry inside the dongle provides a," quote unquote, "'secret' or at least hard-to-duplicate value that copy protection code can read and verify."[34] The problem with all of these, is that if the dongle, lensolk, or manual is lost, we can't play the game, or at least not in its entirety.

The third and final method Aycock identified was “what you are”. He briefly mentions DNA and fingerprints, which are not relevant to old videogames, but might become an issue in the near future. What is more relevant to the study of older videogames is the ways in which housing media were used to enforce copy protection. Many younger gamers might not know this, but there was a time were videogames came on cassette tapes. I know I certainly didn’t. To deter game copiers, certain cassettes used what’s called code obfuscation. For instance, the Commodore 64 used Freeload, a tape loader for that platform, which could load a game in fourteen parts.[35] Also, sometimes loud sounds were inserted on the cassettes to trick recorder into lowering the recording volume temporarily. Creators hoped that the sound on the copy would be too low to be read properly.[36] These tactics were only for cassettes though; every medium has its own copy protections and can be easier or harder to copy.

Copying cartridges is inherently more difficult than cassettes. If you wanted to copy a ROM on an EPROM, it required significant skill and equipment. It was even possible to copy a cartridge’s content on a tape or a disk, and then later restore it in RAM, without needing to put it back on a cartridge. So to counter this, “some cartridge’s code would copy garbage into its own memory addresses: this would have no effect on the cartridge’s code in ROM, but a copy in RAM could be corrupted.”[37]

In the case of floppy disks, manufacturers used four methods. They sometimes purposefully damaged parts of a disk, making copies unreadable; used expensive disk duplicating equipment that would write in ways that low-cost drives couldn’t; changed the location of the disk directory, which was typically at the middle of the disk; or changed the track bit density to non-standard values.[38] Another, though less successful tactic, was to use boot codes to access the

secrets of reading the data.[39] Of course, this could be easily worked around for anyone with access to the codes.

While these tactics of copy protection were useful to prevent piracy, they also make it much harder for heritage institutions to preserve videogames outside of their original medium. This is not to say that it's impossible, because unauthorised copies of games exist, so hackers and crackers managed to circumvent those protections. And as I said earlier, doing so is even sometimes permitted for preservation purposes.[40]

So, cracking a game is difficult, and even if you manage to do it, you could lose the external copy protection, making it impossible to play?

Yep, you got it. There's one thing that's encouraging though. Like I said before, people have been copying and cracking videogames for a long time. And they have been dealing with these issues and working around them. Skot Deeming, who I mentioned before, has done a lot of research on this very subject.

> Skot: 'when we talk about preservation of, like, games and software institutionally, we often ignore the fact that all of this work is being done in vernacular culture, all the time.'
> Dany: 'Yeah.'
> Skot: 'And that's the benefit, because one of the things that happens is regardless of what people in the academy or the, or like the archival or museum institutions are doing… they don't acknowledge all the labour that's been done before, that does the work that their doing'
> Dany: 'Yeah.'
> Skot: 'Right? It's, it adds this like, this, the, the institutionalisation of these thing as that hier, sort of hierarchical knowledge'
> Dany: 'Yeah, yeah, yeah.'
> Skot: 'and prestige to these things'
> Dany: 'Hmph.'
> Skot: 'when fans and, you know, hackers and crackers and all of these people have been doing that work'
> Dany: 'Hmph.'
> Skot: 'right? And I, and I think it's really important to acknowledge.'
> Dany: 'Yeah.'

Academia has to start looking outside of the university walls, and has to find the people or groups that create these unauthorised copies. They are the ones who hold the knowledge heritage institutions and universities want and need. This also means those interested in preserving games must look to poorer countries, like Mexico.

> Skot: "being in Mexico is so different.'
> Dany: 'Yeah, yeah.'
> Skot: 'Like, everything is pirated.'
> Dany: [subtle laugh]
> Skot: 'Finding something that's licensed, is... the rarity!'
> Dany: 'Hmph.'
> Skot: 'The ubiquity of pirated goods, like […]'

Because there's such a large market of unauthorised copies, that's where researchers will find the knowledge to crack or copy games. And we need to do so before we can't play older videogames.

This is making me think, what happens when a console or a computer stops working?

We call those platforms, and it's the final problem I want to address. Platforms and accessories also degrade, but they can also simply become lost. We might have a perfectly functional copy of a game, but the original platform or controller might be lost. Then again, even if we still have functioning hardware, can we still make it work? What happens when a console can only be connected to a CRT TV and those are no longer around? Not to mention that even if you could connect to a newer TV, it's not going to look the same.

That's depressing. *sad music* The fact that so many things can disappear or just make the experience different makes this look like a lost cause.

No, no, no. That's why my typology and what I consider to be part of a videogame is so vast.

What do you mean?

Well let's imagine a hypothetical situation where we would have two games for which there was no original version left. And both games' "Creator", "Paragame", and "Social" categories held the exact same things. Same amount of marketing material, the community is as active, etc. They would be at the same point on the degree of deadness scale. Now, say that one of them had a modding community and the other didn't. If we had access to these mods, then the one with the modding community would be more alive than the one without. We could use the mods to try and preserve the game. On top of that, not everyone is going to experience a vanilla, or unaltered, version of a videogame.[41] Some games, like *Skyrim*, can be easily be modded, while others can't. The computer version of this game has a very active modding community. It's less so the case for the console versions, but it still exists. In *Skyrim*'s case, if you want to understand player experience, you need to preserve and analyse mods. Some people created entire new storylines for that game. And yes, I also include the mods that let you see everyone naked.

What is it with you and pornography?

Like I said in previous episodes, I include everything in what I consider to be part of a game. For me, even porn of a game retains some of the game's aura. The reason I bring it up again is because I feel like, sometimes it's disregarded or outright demonised. I recognise that it can be and very often is problematic; I've said this before. But not paying attention to it is not going to help.

Feel free to disagree, but what I'm trying to say here, is that a game can't really die if you take into account everything, mods, websites, cosplay, and all the other things that derive from the "original" game. Now, it's not to say that trying to track down the so-called originals is pointless; we still want them! The material aspect of a game, the housing medium (diskettes, cartridge, CD,

etc.) can and will die. But it's not the end all be all; there's much more to videogames, and to other artifacts for that matter, than the original. Skot had an interesting take on this:

> Skot: 'One of the things, I mean, this is the Deadplay project, right?'
> Dany: 'Hmph.'
> Skot: 'The question'
> Dany: 'Yeah.'
> Skot: 'there's, nothing is dead! Nothing is dead!'
>
> [taken from later clip in the interview]
>
> Skot: 'All media is kind of like zombie media now.'
> Dany: 'Yeah.'

Isn't that slightly contradictory to what you've been saying all along? That videogames can die?

I don't think so. I think the greater idea of a game can't really die, maybe except if it's entirely forgotten in the next decades or centuries. But a version of a game can definitely die. In episode 1 part 2, I mentioned James Newman's example of *Donkey Kong*. Say the arcade version of that game was lost, there might still be an Atari version somewhere. And if there were no longer any version of the original *Donkey Kong* game, we might still have functional copies of *Donkey Kong Country* on the Super Nintendo. Even though it's not the original *Donkey Kong*, it still has some of its aura.[42] It was based on the original one. Plus, for me, that's my original, it's the first one I played. Authenticity is subjective.[43] Then again, *Donkey Kong* is a very popular videogame series. So, there's a lot of things that keep that game's aura.

Try to remember in the first part of this episode, I mentioned *Night Flight* for the TRS-80. There's nothing that proves it was a popular or successful game. I can't find anything on it except for the manual that was with it in the Canada Science and Technology Museum's collection. If that cassette tape is dead, the only way to bring it back to life is with that manual. In essence, using that manual, I can try to bring that game back to life, even if it's only a shadow of its former self.

In the next episode, we talk about bringing dead games back to life as zombie games using practical necromancy. Please stay tuned! I would like to thank Rebecca Baker, who is the other voice you heard throughout the podcast, and Racoon City Massacre for giving me permission to use their music. The theme song for Deadplay comes from their song "Where They Walk Alone." You can find more of their music on Bandcamp. *outro* They also have a Facebook page and a Twitter! Thank you so much and see you next time!

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[1] James Newman, *Best Before: Videogames, Supersession and Obsolescence* (New York: Routledge, 2012), 1.
[2] "Bit Rot," Software Preservation Society, last modified May 7, 2009, http://www.softpres.org/?id=glossary:bit_rot.
[3] Ibid.
[4] Blackjax, "A Small Lesson in Bit Rot," *System Failure*, accessed December 8, 2005, http://my.ais.net/~xtreme/SF/Bit-Rot/ quoted in Monnens & al. "Before It's Too Late," 142. Ironically, this website is now dead. A copy exists at the Internet Archive. See https://web.archive.org/web/20120817134557/http://my.ais.net:80/BD/05/xtreme/SF/Bit-Rot/.
[5] Devin Monnens, Zach Vowell, Judd Ehtan Ruggill, Ken S. McAllister, and Andrew Armstrong, "Before It's Too Late: A Digital Game Preservation White Paper," edited by Henry Lowood, *American Journal of Play* (Fall 2009): 142.
[6] When I visited the Strong Museum of Play, I was surprised when they told me that their copies of *Seven Cities of Gold* were supposed to be functional. Indeed, some of them were. Andrew Borman, Digital Games Curator at the Strong, told me in conversation that when games are kept in ideal circumstances, they can outlive their expected lifespan.
[7] Monnens & al., "Before It's Too Late," 141.
[8] "Bit Rot," Software Preservation Society, last modified May 07, 2009, http://www.softpres.org/glossary:bit_rot.
[9] The Software Preservation Society describes this process stating that the bit cells on these disks "slowly lose their polarity, and flux transitions are no longer detected, or falsely detected." See "Bit Rot," Software Preservation Society, last modified May 07, 2009, http://www.softpres.org/glossary:bit_rot.
[10] "Bit Rot," Software Preservation Society.
[11] Monnens & al., "Before It's Too Late," 142.
[12] Monnens & al., "Before It's Too Late," 142-143.
[13] Ibid, 142.
[14] Blackjax, "A Small Lesson in Bit Rot."
[15] Newman, *Best Before*, 11.
[16] Monnens & al., "Before It's Too Late," 160.
[17] Jason Scott, "Saving Game History Forever - Or Dooming It To Oblivion?," accessed November 21, 2017, http://www.gdcvault.com/play/1022240/Saving-Game-History-Forever-Or.
[18] John Aycock, *Retrogame Archeology: Exploring Old Computer Games* (Basel: Springer International Publishing Switzerland, 2016): 209.
[19] Here, I am referring to the marginalia of literary or medieval history.
[20] Olivier Charbonneau, Marie-Ève Guibord, Marie Hélène Labory, Olivier Ménard, Brigitte Moreau, Sophie Morissette, and Raphaella Dixon, "Droit d'Auteur en Contexte Scolaire: Un Modèle d'Utilisation Équitable des Œuvres Littéraires et Artistiques dans les Écoles du Québec / Le Chantier du Droit d'Auteur en Milieu Scolaire" (presentation, Congrès des Milieux Documentaires, Montréal, Canada, October 31 to November 2, 2012), accessed May 27, 2018, http://spectrum.library.concordia.ca/974927/.
[21] Sean Tudor, former assistant curator of communications and current manager of collection services at the Canada Science and Technology Museum, in discussion with the author, November 2017.
[22] Oliver Charbonneau (librarian and PhD candidate at the Centre de Recherche en Droit Public of l'Université de Montréal), e-mail message to author, August 16, 2017.

[23] Ibid.
[24] There is extensive work on this issue in orphan work literature. The American Library Association defines orphan work as "works whose copyright holders cannot be identified or found – and are not made publicly available by libraries for fear that rights holders will come forward, initiate legal action, and demand statutory damages of up to $150,000 a work." (American Library Association 2008) This issue still plagues preservation and use of copyrighted material, though there have been interesting developments and research in the past few years. See "Copyright: Orphan Works," American Library Association, last modified October 24, 2008. http://www.ala.org/advocacy/copyright/orphan; Erez Rosenberg, "An Audio-Visual Notice of use of Database: A Solution to the Orphan Works Problem in the Internet Age," UCLA Entertainment Law Review 22, no. 1 (2014): 95-132; Abigail Bunce, "British Invasion: Importing the United Kingdom's Orphan Works Solution to United States Copyright Law," Northwestern University Law Review 108, no. 1 (2014): 243-281; Giuseppina D'Agostino, Margaret Hagan, and Canadian Heritage. *Orphan Works Hackathon: Final Report of the Concepts, Process and Insights*. Report, Ottawa: Canadian Heritage, 2016, http://oaresource.library.carleton.ca/wcl/2017/20170126/CH4-177-2016-eng.pdf.
[25] *Copyright Act*, RSC 1985, c C-42, accessed December 13, 2017, http://canlii.ca/t/52zkj.
[26] "Bill C-11: The Copyright Modernization Act," *University of British* Columbia, accessed December 13, 2017, http://copyright.ubc.ca/guidelines-and-resources/support-guides/bill-c-11-the-copyright-modernization-act/.
[27] U.S. Copyright Office, Library of Congress, "Exemption to Prohibition on Circumvention of Copyright Protection Systems for Access Control Technologies," 2015-27212, October 28, 2015, https://www.federalregister.gov/documents/2015/10/28/2015-27212/exemption-to-prohibition-on-circumvention-of-copyright-protection-systems-for-access-control.
[28] See Mia Consalvo, "Unintended Travel: ROM Hackers and Fan Translations of Japanese Videogames" in *Gaming Globally: Production, Play, and Place* Huntemann N.B., Aslinger B. (eds) (Palgrave Macmillan, New York, 2013)
[29] John Aycock, "Protection," in *Retrogame Archeology: Exploring Old Computer Games* (Basel: Springer International Publishing Switzerland, 2016): 145-171.
[30] Aycock, *Retrogame Archeology*, 146.
[31] Ibid, 147.
[32] Ibid, 149.
[33] Ibid.
[34] Ibid,
[35] Ibid, 154.
[36] Ibid, 155.
[37] Aycock, *Retrogame Archeology*, 155.
[38] Ibid, 155-160.
[39] Ibid, 160.
[40] This is the case of exemptions to the DMCA and the Canadian Copyright Act (articles 29, 29.1, 29.2, 30.1, and 30.2). Oliver Charbonneau (librarian and PhD candidate at the Centre de Recherche en Droit Public of l'Université de Montréal), e-mail message to author, August 16, 2017. See *Copyright Act*, RSC 1985, c C-42, accessed August 17, 2017, http://canlii.ca/t/52zkj, Maria Scheid, "New DMCS Exemptions," *Ohio State University Libraries*, published on December 30, 2015, https://library.osu.edu/blogs/copyright/2015/12/30/new-dmca-exemptions/, and U.S. Copyright Office, Library of Congress, "Exemption to Prohibition on Circumvention of Copyright Protection Systems for Access Control Technologies," 2015-27212, October 28, 2015, https://www.federalregister.gov/documents/2015/10/28/2015-27212/exemption-to-prohibition-on-circumvention-of-copyright-protection-systems-for-access-control.
[41] See Episode 1 Part 2, note 4.
[42] Here, Slack and Wise's take on culture helps frame this line of argument. They argue that "culture is never static; rather it is a process that entails changing relationships between what is old, what is new, and what is being reconfigured" (Slack and Wise 2015, 6). This highlights the fluidity of culture and even the concept of *Donkey Kong*. See Jennifer Daryl Slack and J. Macgregor Wise, *Culture and Technology: A Primer*, second edition (New York: Peter Lang, 2015).
[43] There is a long-standing debate between authenticity and accuracy. David Dean discusses this in an article on a Canadian adaption of King Lear in which characters were reinvented as members of Canadian First Nations. See David Dean, "Negotiating Accuracy and Authenticity in an Aboriginal King Lear," *Rethinking History* 21, no. 2 (2017): 255-73.