Ghost

Sharp

Designed by Lucas Sharp
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Available in 72 styles
Licenses for Web, Desktop & App

Family Overview

Ghost Display Extrabold
Ghost Display Extrabold Italic
Ghost Display Bold
Ghost Display Bold Italic
Ghost Display Semibold
Ghost Display Semibold Italic
Ghost Display Medium
Ghost Display Medium Italic
Ghost Display Regular
Ghost Display Italic
Ghost Display Light
Ghost Display Light Italic

Ghost Text Extrabold
Ghost Text Extrabold Italic
Ghost Text Bold
Ghost Text Bold Italic
Ghost Text Semibold
Ghost Text Semibold Italic
Ghost Text Medium
Ghost Text Medium Italic
Ghost Text Regular
Ghost Text Italic
Ghost Text Light
Ghost Text Light Italic

Family Overview

Ghost Display SemiMono Extrabold
Ghost Display SemiMono Extrabold Italic
Ghost Display SemiMono Bold
Ghost Display SemiMono Bold Italic
Ghost Display SemiMono Semibold
Ghost Display SemiMono Semibold Italic
Ghost Display SemiMono Medium
Ghost Display SemiMono Medium Italic
Ghost Display SemiMono Regular
Ghost Display SemiMono Italic
Ghost Display SemiMono Light
Ghost Display SemiMono Light Italic

Ghost Text SemiMono Extrabold
Ghost Text SemiMono Extrabold Italic
Ghost Text SemiMono Bold
Ghost Text SemiMono Bold Italic
Ghost Text SemiMono Semibold
Ghost Text SemiMono Semibold Italic
Ghost Text SemiMono Medium
Ghost Text SemiMono Medium Italic
Ghost Text SemiMono Regular
Ghost Text SemiMono Italic
Ghost Text SemiMono Light
Ghost Text SemiMono Light Italic

Family Overview

Ghost Display Mono Extrabold
Ghost Display Mono Extrabold Italic
Ghost Display Mono Bold
Ghost Display Mono Bold Italic
Ghost Display Mono Semibold
Ghost Display Mono Semibold Italic
Ghost Display Mono Medium
Ghost Display Mono Medium Italic
Ghost Display Mono Regular
Ghost Display Mono Italic
Ghost Display Mono Light
Ghost Display Mono Light Italic

Ghost Text Mono Extrabold
Ghost Text Mono Extrabold Italic
Ghost Text Mono Bold
Ghost Text Mono Bold Italic
Ghost Text Mono Semibold
Ghost Text Mono Semibold Italic
Ghost Text Mono Medium
Ghost Text Mono Medium Italic
Ghost Text Mono Regular
Ghost Text Mono Italic
Ghost Text Mono Light
Ghost Text Mono Light Italic

Extrabold 74pt

RASTERIZED

Bold 74pt

WARCRAFT II

Semibold 74pt

AREA 51 DX 3

Medium 74pt

RECOVERING

Regular 74pt

ENTERHEREX

Light 74pt

UNLEARNING

Extrabold Italic 74pt

Bold Italic 74pt

Semibold Italic 74pt

Medium Italic 74pt

Regular Italic 74pt

Light Italic 74pt

Extrabold 74pt

Nitendo 64®

Bold 74pt

Overdevelop

Semibold 74pt

Animatedgif

Medium 74pt

Metaphysical

Regular 74pt

Resident Evil 1

Light 74pt

Standardizing

Extrabold Italic 74pt

Complexities

Bold Italic 74pt

Forewarning

Semibold Italic 74pt

Dukenukemi

Medium Italic 74pt

Virtua Fighter

Regular Italic 74pt

Randomisers

Light Italic 74pt

Standardised

Extrabold 74pt

ALGORITHM

Bold 74pt

TAPEDRIFTX

Semibold 74pt

BOOTLOOPS

Medium 74pt

ANALOGIZER

Regular 74pt

WINDOWING

Light 74pt

USERFRAME

Extrabold Italic 74pt

Bold Italic 74pt

Semibold Italic 74pt

Medium Italic 74pt

Regular Italic 74pt

Light Italic 74pt

Extrabold 74pt

Windows 98

Bold 74pt

Headphones

Semibold 74pt

Timecapsule

Medium 74pt

Dreamscape

Regular 74pt

Narrowcasts

Light 74pt

Outsmarting

Extrabold Italic 74pt

Daydreamer

Bold Italic 74pt

Multiplayers

Semibold Italic 74pt

Command+C

Medium Italic 74pt

Despatching

Regular Italic 74pt

Superflash 2

Light Italic 74pt

Boomblaster

Extrabold 37pt

CRT//SYNC?LOSS#DETCX
View source code regX Alt

Bold 37pt

WEB 2.0 # IS ALL ABOUT ϟ
Reading, Writing, Creating

Semibold 37pt

♲ WORLD WIDE WEB [3.0]
1 Interacting with end user

Medium 37pt

FOUR DESIGN ESSENTIALS
Server’s file system vholdx

Regular 37pt

PAGES BUILT USING SERVER
Common Gateway Interface

Light 37pt

EASY TO CONNECT ≡ LINKS
Static page with the system

Extrabold Italic 37pt

U-GENERATED CONTENTS (intuit interfaces for users)

Bold Italic 37pt

HTML PAGES TO DYNAMIC User-editable platforms

Semibold Italic 37pt

DIALOGUE WITH VIRTUAL ⁂ Collab and social media

Medium Italic 37pt

CONTENT ✳ IN REAL TIME ♻ (intuitive interface for users)

Regular Italic 37pt

BENEFICIAL BUT GRADUAL 2000s, RSS feeds, and AJAX

Light Italic 37pt

APIS TO ALLOW SELF-USAGE, Podcasting, Blogging, Tagging

Extrabold 37pt

NEW UPDATES ADDED -F
Plunderage Programmer

Bold 37pt

ITS MAIN CPU TWO-WAY
Hitachi SH-4 32-bit RISC

Semibold 37pt

OUTS CORRESPONDENTS
The 32-bit era, landscape

Medium 37pt

LOT DENOMINATIONALLY
Problematically Paranoid

Regular 37pt

QUALITY OVER QUANTITY
Arcades are still buzzing ¶

Light 37pt

NEURONAL MONTEVIDEO
© [Sega Saturn Consoles]

Extrabold Italic 37pt

32-BIT HANDHELD GAME
Cuture ✲ to believe in Xx

Bold Italic 37pt

THE BATTLEFIELD TAKES
Shape, ’90s battleground

Semibold Italic 37pt

RADCLIFFE CARICATURED
Visions of gaming’s future

Medium Italic 37pt

SCANLINE OFFSET SHIFT//
Atten lvl-3db _ERR !!404!!

Regular Italic 37pt

OPTIMIZED FOR 800 × 600
Unsystematic Malingered

Light Italic 37pt

DEXTEROUSLY CONTENTS
Administrated Aestivated

Extrabold 74pt

VECTORMAP

Bold 74pt

WIN95BOOT

Semibold 74pt

EXHIBITING

Medium 74pt

MEGABYTES

Regular 74pt

WINAMPIFY

Light 74pt

SOUNDBLIST

Extrabold Italic 74pt

PASSWORDS

Bold Italic 74pt

STACK OVER

Semibold Italic 74pt

GAMESFILES

Medium Italic 74pt

SOULEDGEXI

VHSGLITCHX

Light Italic 74pt

CYBERNETIC

Extrabold 74pt

Archdeacon

Bold 74pt

Wiederfind

Semibold 74pt

Glamorized

Medium 74pt

Interactive

Regular 74pt

Strategical

Light 74pt

Packet Loss

Extrabold Italic 74pt

Weatherize

Bold Italic 74pt

Paragraphs

Semibold Italic 74pt

Cipher Core

Medium Italic 74pt

Quadrupled

Regular Italic 74pt

Diskhantom

Light Italic 74pt

Uninitiated

Extrabold 74pt

VAPORWARE

Bold 74pt

COMMUTERS

Semibold 74pt

PIXELGRIDS

Medium 74pt

NARROWING

Regular 74pt

DISSERVICE

Light 74pt

RETROUIFXS

Extrabold Italic 74pt

DREAMLAND

Bold Italic 74pt

STATICALLY

Semibold Italic 74pt

CRACKDOWN

Medium Italic 74pt

UNDAMAGED

Regular Italic 74pt

FANTASIZES

Light Italic 74pt

JPEGARTFXS

Extrabold 74pt

Scoreboard

Bold 74pt

Bitmapdata

Semibold 74pt

Suppressed

Medium 74pt

Timeattack

Regular 74pt

Modeselect

Light 74pt

Toolmakers

Extrabold Italic 74pt

Ecosystems

Bold Italic 74pt

Overlooker

Semibold Italic 74pt

Purpleglow

Medium Italic 74pt

Chromashft

Regular Italic 74pt

Retrowaves

Light Italic 74pt

Reproducer

Extrabold 37pt

DREAMCAST MEASURES
NVRAM:CLR/EXEC#CMD

Bold 37pt

MAIN CPU I9 TWO-WAY
Hitachi SH-4 bit RISC

Semibold 37pt

GRAPHICAL HARDWARE
Spatial anti-aliasing

Medium 37pt

WM-BUFFERING-SPATIAL
Per-pixel translucency

Regular 37pt

PROGRESSIVE SC VIDEO
16.7 million colors Mz

Light 37pt

67 MHZ YAMAHA AICA⁴⁵
32-BIT ARM-7 RISC CPU

Extrabold Italic 37pt

12 × SPEED YAMAHA GD
Window CE - Dreamcast

Bold Italic 37pt

A/V CABLES MODULATOR
S-Video & Scart VGRAM

Semibold Italic 37pt

3D® DIVERS 2000 CX-1
Sonic's head software

Medium Italic 37pt

NT:ROM:CRC_BAD#FLAG
Veronica C. variations

Regular Italic 37pt

CONTROLLER INPUTS 3D
Analog stick / a D-pad

Light Italic 37pt

HALL EFFECT SENSORS/A
Non-volatile memory ↩

Extrabold 37pt

{ALL LICENSED GAMES}
CD-based optical disc

Bold 37pt

CELL SIGNAL ENCODING
(FDMA) system eNB LTE

Semibold 37pt

BROADBAND USB MODEM
↳Smart (bottom-right)

Medium 37pt

CELLULAR RADIO TOWER
Nodes is wireless A/H

Regular 37pt

MULTIPLE INPUT/OUTPUT
3GPP 4G LTE and 5G NR

Light 37pt

CAPACITY & EFFICIENCY
High. frequency signal

Extrabold Italic 37pt

CELLULAR 1G GEN (NTT)
♦ Tel. system by AT&T

Bold Italic 37pt

1G SYSTEMS IN GHANA
Millicom Cellular SA

Semibold Italic 37pt

GRAPHICAL HARDWARE
Spatial anti-aliasing

Medium Italic 37pt

D=R{Ⅱ\SQRT{⅓}→ERROR
Rad.(0.62 to 18.6 mi)⚠

Regular Italic 37pt

A REUSE PATTERN N/K
6/4 (Motorola NAMPS)

Light Italic 37pt

SGS_CS AND SGS_PS/SC
data packets need NME

Extrabold 74pt

VIDEOTAPES

Bold 74pt

ANALOGWAVE

Semibold 74pt

SIGNALLOSS

Medium 74pt

SNOWSCREEN

Regular 74pt

DISTORTION

Light 74pt

TIMECODEFX

Extrabold Italic 74pt

TAPEHISSFX

Bold Italic 74pt

BLURRYTAPE

Semibold Italic 74pt

SHADOWPLAY

Medium Italic 74pt

LNGOFFS/HI

Regular Italic 74pt

NOISEFLOOD

Light Italic 74pt

GHOSTFRAME

Extrabold 74pt

Clr//exec#

Bold 74pt

Goldenaxet

Semibold 74pt

Magicsword

Medium 74pt

Crazitaxi2

Regular 74pt

Pilotwings

Light 74pt

Pixelfonts

Extrabold Italic 74pt

Earthbound

Bold Italic 74pt

Worldheros

Semibold Italic 74pt

Spinmaster

Medium Italic 74pt

Outrunners

Regular Italic 74pt

Rastansaga

Light Italic 74pt

Waverace64

Extrabold 74pt

TAPEDAMAGE

Bold 74pt

FASTFORWAR

Semibold 74pt

OVERDRIVEN

Medium 74pt

FINALFIGHT

Regular 74pt

SUNSETVHSX

Light 74pt

COLORBLEED

Extrabold Italic 74pt

VIDEODRIFT

Bold Italic 74pt

LUMASHIFTX

Semibold Italic 74pt

SOFTSTATIC

Medium Italic 74pt

FLASHBACKX

Regular Italic 74pt

VIDEOSTORE

Light Italic 74pt

LIVINGROOM

Extrabold 74pt

Popupalert

Bold 74pt

Overlapfxs

Semibold 74pt

Glitchcore

Medium 74pt

Datastream

Regular 74pt

Rasterized

Light 74pt

Windowtile

Extrabold Italic 74pt

Hypertextx

Bold Italic 74pt

Bestviewed

Semibold Italic 74pt

Marqueetag

Medium Italic 74pt

Homepagely

Regular Italic 74pt

Button88px

Light Italic 74pt

Rainbowtxt

Extrabold 37pt

PIXELS RENDERS MODE
crt glowing effectX

Bold 37pt

VECTOR PROCESSING U
video-games console

Semibold 37pt

MEMORY OVERFLOWLOPS
Static data noise 2

Medium 37pt

STAR-100 SPRITE NGI
raster scanning=1.0

Regular 37pt

DIGITAL SIGNAL FX-5
vhs4 tracking lines

Light 37pt

MODEM-RI HANDSHAKEX
-1/ dial tone buffer

Extrabold Italic 37pt

TEXTURE CACHEMAP GI
Collowres dithering

Bold Italic 37pt

₪ BINARY ✲ DREAMWAY
Hitachi SH-4 bit RI

Semibold Italic 37pt

SAVEFILE SYSTEM CMD
ws soft glitch echo

Medium Italic 37pt

IRQ VECTOR TABLE IN
Interrupt maploaded

Regular Italic 37pt

DMA CHANNEL LOCKEDX
Buffer wait state.6

Light Italic 37pt

MOS BATTERY LOWFLAG
⚠ drift warning log

Extrabold 37pt

LASERDISC 2.0 OFFSET
Frame index recalibs

Bold 37pt

PHOSPHR DECAY TIMING
Afterglow latencyLog

Semibold 37pt

BOOT SECTOR CHECKSUM
CRC / verify pending

Medium 37pt

TRACKING SERVO ALIGN
Head azimuth control

Regular 37pt

RGB’s CABLE MODE CRL
Faded neon irn latch

Light 37pt

BOOT ROM HEX PATCHDX
Opcode remap applied

Extrabold Italic 37pt

JAMMA PINOUT CHECKSUM
Ghost images_mode ali

Bold Italic 37pt

SCANLINE PHASE ADJUST
Vertical hold tweakFX

Semibold Italic 37pt

CRT SYNCS CALIBRATION
VHS phase offset ctrl

Medium Italic 37pt

ARCADE I/OS BUS RESET
Coin pulse signal map

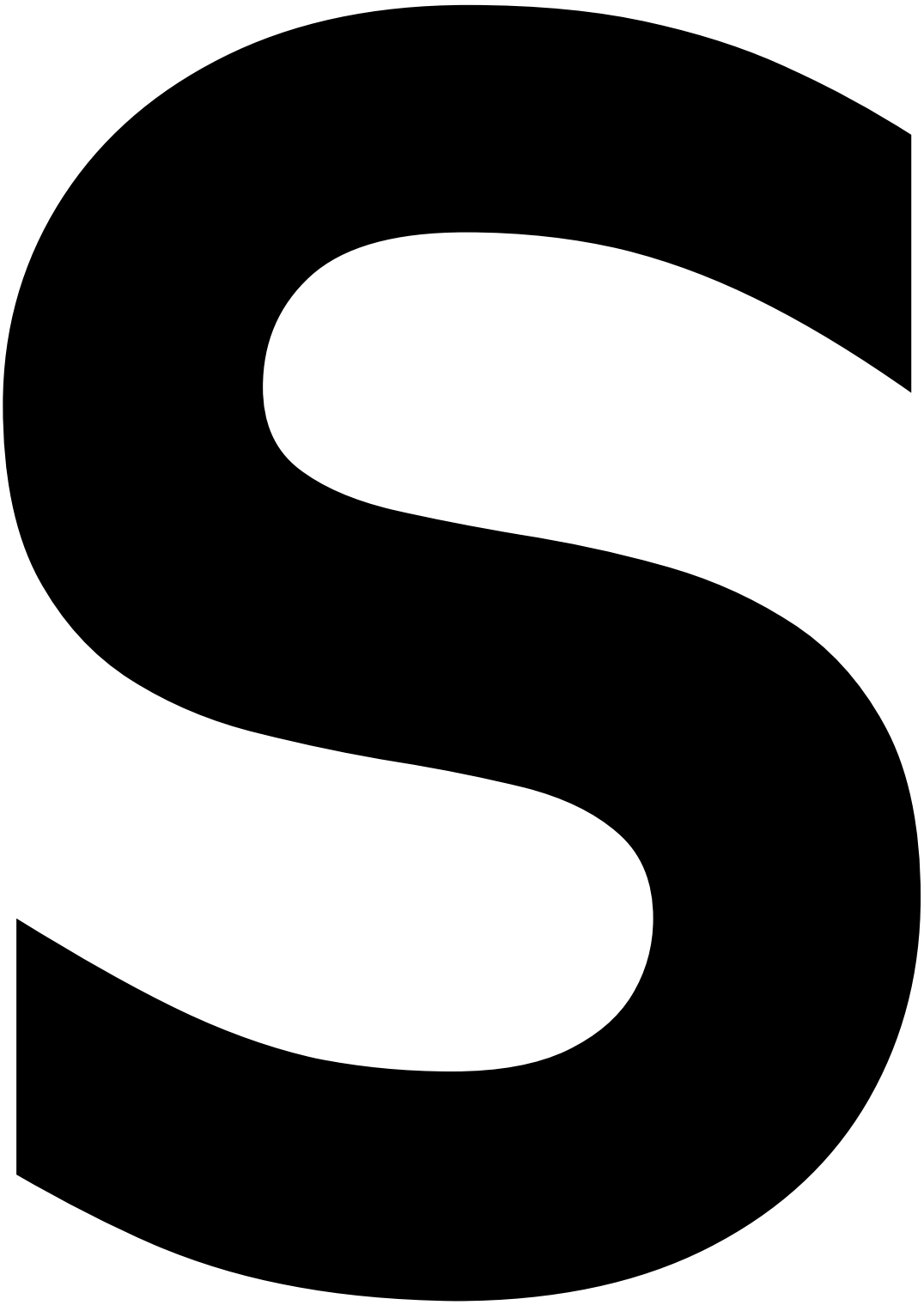
Regular Italic 37pt

RGB HV DRIVE LEVELSX
Analog gain trim set

Light Italic 37pt

EPROM CRC VERIFY CMD
Nvram SRM12C1FI dump

835pt



Extrabold 10pt /12

Between 1990 and 1992, the video game industry appeared relentlessly forward-looking. The 16-bit era, led by the Super Nintendo Entertainment System and the Sega Genesis, focused on graphical advancement and competitive marketing rather than preservation. Hardware cycles were short, cartridges were disposable commodities, and retailers rapidly cleared older inventory. Yet beneath this surface acceleration, early forms of nostalgia quietly emerged among players who had grown up with Atari, NES, and early PC systems.

Bold 10pt /12

During the early 1990s, secondary markets began forming informally. Flea markets, garage sales, and classified ads in local newspapers became unexpected hubs for discontinued cartridges and consoles. Because publishers rarely maintained back catalogs, older titles fell out of circulation quickly. This scarcity unintentionally seeded collector behavior. What was initially practical—replacing broken childhood cartridges—gradually evolved into deliberate acquisition and archiving.

Semibold 10pt /12

Secondary markets emerged organically during this period. Flea markets, garage sales, and classified advertisements became informal redistribution networks for discontinued cartridges and aging consoles. Because publishers rarely maintained back catalogs or reprinted older titles, scarcity developed quickly. What began as pragmatic replacement buying gradually transformed into intentional collecting. Some players started preserving boxes, manuals, and inserts, recognizing that these materials were already disappearing.

Medium 10pt /12

Bulletin Board Systems, or BBS communities, contributed significantly to early preservation discourse. Although many were associated with software distribution, they also hosted detailed text files documenting release dates, regional variations, cheat codes, and hardware revisions. This culture of documentation preceded formal archival efforts. Users compiled FAQs and version histories, inadvertently constructing the first decentralized databases of gaming knowledge long before corporate or academic interest appeared.

Regular 10pt /12

Arcade decline in North America after 1992 intensified preservation awareness. As fighting game cabinets dominated briefly before revenue dropped, operators began liquidating machines. Enthusiasts purchased boards and cabinets, moving commercial hardware into private spaces. This transfer marked a turning point: arcade machines ceased being purely revenue-generating installations and became collectible artifacts. Maintenance knowledge—monitor calibration, board repair, parts sourcing — started circulating informally among hobbyists.

Light 10pt /12

On personal computers, compatibility issues fostered another preservation impulse. DOS-based games struggled under evolving operating systems such as Windows 3.1 and later Windows 95. Users documented memory configurations, sound card drivers, and command-line parameters required to keep older titles functional. Technical troubleshooting threads on Usenet and early forums functioned as collaborative archives. In solving obsolescence problems, players were also preserving playability and historical continuity.

Extrabold Italic 10pt /12

Around 1993 and 1994, the rapid adoption of CD-ROM technology accelerated generational turnover. Publishers promoted full-motion video, orchestrated soundtracks, and expansive storage capacity as hallmarks of a new era. Cartridge-based systems were framed as technically limited relics. Retail shelf space shifted toward PlayStation, Sega Saturn, and multimedia PC titles. This abrupt repositioning implicitly marginalized 8-bit and early 16-bit libraries, intensifying emotional attachment among players who sensed cultural displacement.

Bold Italic 10pt /12

Simultaneously, the early public internet began reshaping documentation practices. Usenet groups such as rec.games.video.console and alt.games.video.arcade hosted structured discussions about release timelines, regional differences, and "best of all time" rankings. These debates produced proto-histories, organizing games into eras and stylistic movements. The act of ranking fostered awareness that video games possessed developmental phases worthy of comparative analysis and long-term reflection.

Semibold Italic 10pt /12

Personal websites hosted on GeoCities, Tripod, and Angelfire became decentralized archives. Fans uploaded scanned manuals, sprite sheets, MIDI recreations of soundtracks, and detailed walkthrough text files. Despite their visually chaotic layouts—animated GIFs, tiled backgrounds, visitor counters—these pages functioned as community-driven repositories. The aesthetic of early web design concealed a serious archival effort rooted in enthusiasm rather than institutional mandate.

Medium Italic 10pt /12

By 1995, the notion of "classic games" began appearing more frequently in discourse. Magazine retrospectives revisited early arcade hits and console milestones, often framing them as foundational rather than obsolete. This subtle linguistic shift—from outdated to classic—signaled an emerging cultural revaluation. While the industry prioritized polygon counts and 3D acceleration, segments of the player base increasingly perceived earlier generations as formative chapters rather than discarded prototypes.

Regular Italic 10pt /12

Urban planner and author John Claudius Loudon was one of the first professional cemetery designers, and his book On the Laying Out, Planting and Managing of Cemeteries (1843) was very influential on designers and architects of the period. Loudon himself designed three cemeteries — Bath Abbey Cemetery, Histon Road Cemetery, Cambridge, and Southampton Old Cemetery. The Metropolitan Burial Act 1852 legislated for the establishment of the first national system of government-funded municipal cemeteries across the country.

Light Italic 10pt /12

The urban cemetery is a burial ground located in the interior of a village, town, or city. Early urban cemeteries were churchyards, which filled quickly and exhibited a haphazard placement of burial markers as sextons tried to squeeze new burials into the remaining space. As new burying grounds were established in urban areas to compensate, burial plots were often laid out in a grid to replace the chaotic appearance of the churchyard. Urban cemeteries developed over time into a more landscaped form as part of civic development of beliefs and institutions.

Extrabold 10pt /12

Between 1996 and 1997, 3D acceleration reshaped the industry's visual language. Titles built around polygonal environments and texture mapping dominated marketing campaigns. Graphics cards such as 3dfx Voodoo became status symbols within PC communities. In contrast, sprite-based games appeared technologically archaic. Yet this contrast sharpened historical awareness. The more visibly distinct 2D and 3D aesthetics became, the easier it was for players to identify generational boundaries.

Bold 10pt /12

Emulation matured significantly during this period. Projects targeting NES and Game Boy hardware improved compatibility and accuracy, while ROM image circulation expanded through online networks. Although legally contentious, these developments enabled broader access to discontinued software. For many younger players, emulators provided first encounters with earlier libraries. Preservation shifted from purely nostalgic recovery to intergenerational transmission, expanding the audience for legacy systems.

Semibold 10pt /12

Collectors began systematizing acquisition practices. Rather than purchasing isolated childhood favorites, enthusiasts sought complete regional sets, variant cartridges, and promotional materials. Price guides circulated in forums and magazines, introducing market logic into preservation culture. The concept of condition grading—mint, complete in box, cartridge only—became standardized. Material integrity gained importance, signaling a shift from casual nostalgia to structured collecting discipline.

Medium 10pt /12

Arcade preservation also professionalized informally. Enthusiast groups shared schematics, repair tutorials, and parts interchange knowledge across mailing lists. As CRT monitors aged and proprietary boards failed, technical literacy became essential for survival of machines. Repair culture intertwined with historical awareness. Maintaining functionality was no longer merely practical; it was framed as stewardship. Each restored cabinet represented continuity within a rapidly digitizing entertainment landscape.

Regular 10pt /12

The book and blockbuster film helped return the Stanley to its former glory. Now, guests come in droves to see the hotel that inspired one of the scariest horror movies of all time. Given its history, it should come as no surprise that many visitors report strange happenings. Aware of the ghostly rumors, Texas resident Henry Yau booked a last-minute getaway in April of 2016 to "check it out." After arriving, Yau had dinner, then wandered around the Stanley to take photos. Stopping at the staircase, he waited for people to clear the area, then took a picture.

Light 10pt /12

By 1998, the term "retro gaming" had not yet fully solidified, but its foundations were clearly visible. Dedicated web rings connected archival websites, FAQs became encyclopedic, and early digital marketplaces facilitated long-distance cartridge trading. The convergence of nostalgia, documentation, technical replication, and emerging online commerce created structural conditions for future specialized retailers. What began as informal recovery practices had evolved into an identifiable cultural movement.

Extrabold Italic 10pt /12

By the late 1990s, retro gaming culture displayed recognizable structural features. It combined decentralized archiving, technical experimentation, and emerging market behavior into a coherent ecosystem. Unlike earlier nostalgia cycles in film or music, video game preservation required hardware literacy. Cartridges degraded, magnetic media failed, and proprietary chips complicated duplication. This technical fragility intensified urgency and shaped preservation as an active intervention rather than passive remembrance.

Bold Italic 10pt /12

Economically, scarcity operated as both constraint and catalyst. Because publishers rarely reissued 8-bit or early 16-bit catalogs, supply depended on secondary circulation. This absence of institutional stewardship encouraged grassroots market formation. Price discovery occurred through magazine classifieds, early auction boards, and peer-to-peer negotiation. Collectors inadvertently performed market research, mapping demand patterns that commercial actors would later formalize into specialized retail strategies.

Semibold Italic 10pt /12

Culturally, the late 1990s witnessed the gradual reframing of early game design as aesthetic rather than merely technical limitation. Pixel art, chiptune soundtracks, and sprite animation began to be discussed as stylistic forms. What had once been hardware necessity became creative identity. This reinterpretation allowed players to value earlier eras on artistic terms, insulating them from simple technological obsolescence narratives promoted by 3D marketing campaigns.

Medium Italic 10pt /12

Technological abstraction further transformed preservation logic. As emulation improved, the relationship between software and hardware shifted conceptually. A console could now be described through its architecture rather than solely through its physical casing. Documentation expanded to include processor diagrams, timing cycles, and memory maps. Enthusiasts adopted quasi-archival methodologies, producing compatibility lists and revision notes resembling technical catalogs rather than casual fan commentary.

Regular Italic 10pt /12

By 1998, the convergence of nostalgia, emulation, documentation, and secondary commerce had created durable infrastructure. Web rings interconnected archives, mailing lists coordinated hardware repair, and collectors standardized valuation language. Although still fragmented and informal, this network constituted a proto-industry. The groundwork had been laid for the emergence of organized retro retailers in the following decade, built upon practices refined quietly throughout the 1990s.

Light Italic 10pt /12

As the decade closed, broadband adoption began accelerating in urban centers, reducing reliance on dial-up connections. Faster transfer speeds expanded access to ROM archives, scanned manuals, and high-resolution box art. What had once circulated slowly through fragmented networks now moved with greater efficiency. Increased connectivity strengthened community cohesion and enabled more reliable cataloging practices, reinforcing the sense that retro gaming was becoming organized rather than incidental.

Extrabold 10pt /12

Online marketplaces transformed secondary circulation into visible price ecosystems. Early auction platforms allowed collectors to observe bidding patterns across regions, revealing disparities in supply and demand. Transparency altered behavior: rarity could be quantified, condition assessed remotely, and cross-border trade normalized. This shift marked a decisive evolution from informal swap culture toward structured valuation.

Bold 10pt /12

Simultaneously, discourse surrounding authenticity intensified. Questions emerged regarding reproduction cartridges, repaired boards, and the legitimacy of ROM backups. Preservation ethics became contested terrain. Some prioritized access over material originality, while others emphasized physical integrity. These debates refined community norms and established criteria for trust. The negotiation of authenticity would later influence grading systems.

Semibold 10pt /12

The early 2000s also witnessed renewed academic and journalistic interest in game history. Retrospective features, developer interviews, and anniversary compilations began appearing more frequently. This institutional acknowledgment validated earlier grassroots efforts. Once confined to hobbyist forums, historical documentation entered broader media channels. Cultural legitimacy strengthened the idea that games merited preservation.

Medium 10pt /12

By the mid-2000s, the convergence of broadband infrastructure, transparent online markets, authenticity discourse, and legitimized historiography created stable commercial opportunity. What began in the early 1990s as scattered nostalgia and technical troubleshooting had matured into structured demand. Specialized retro retailers could now operate sustainably, drawing upon standardized pricing, informed collectors, and established archival practices.

Regular 10pt /12

The early 1990s were defined by the rivalry between Nintendo and Sega. The Super Nintendo Entertainment System and the Sega Genesis did not merely compete technologically; they cultivated distinct brand identities. Nintendo emphasized polish, character continuity, and family-oriented design, while Sega positioned itself as edgy and youth-driven. These contrasting strategies shaped generational memory, embedding brand loyalty into nostalgia.

Light 10pt /12

Nintendo's transition from the 8-bit Nintendo Entertainment System to the 16-bit Super Nintendo reinforced a perception of lineage. Franchises such as Mario and Zelda acted as connective tissue between hardware generations. This continuity strengthened archival interest because earlier cartridges were not isolated relics but precursors within evolving narratives. Preservation thus became tied to franchise history, encouraging collectors to trace brand evolution chronologically.

Extrabold Italic 10pt /12

Sega's Genesis era, by contrast, embodied speed and experimentation. Aggressive marketing campaigns framed the brand as technologically daring and culturally rebellious. Peripheral experimentation, including add-ons such as the Sega CD and 32X, complicated hardware identity. These expansions, commercially unstable yet technically ambitious, later became focal points of retro fascination. Their short lifespans amplified rarity.

Bold Italic 10pt /12

The launch of Sony's PlayStation in 1994 marked a structural shift in console branding. Sony entered the market with a multimedia identity rather than arcade lineage. Emphasis on CD-ROM capacity, cinematic presentation, and third-party partnerships broadened demographic reach. Unlike earlier console makers, Sony positioned its system within a wider electronics ecosystem. This branding strategy later influenced how collectors contextualized the PlayStation.

Semibold Italic 10pt /12

Meanwhile, NEC's TurboGrafx-16 and SNK's Neo Geo occupied specialized positions. The TurboGrafx-16 struggled for market share outside Japan, yet cultivated a devoted niche audience. The Neo Geo, marketed as an arcade-perfect home system, blurred the boundary between domestic and commercial gaming. Its high cost and cartridge format fostered exclusivity. In retrospect, these brands represent alternative trajectories within the 1990s hardware landscape.

Medium Italic 10pt /12

The release of the Nintendo 64 in 1996 reaffirmed Nintendo's commitment to cartridge media at a moment when CD-ROM had become industry standard. This decision reflected both technological philosophy and brand conservatism. Cartridges enabled faster load times but limited storage capacity and increased production costs. The choice reinforced Nintendo's image as quality-focused yet resistant to prevailing trends, shaping later retrospective debates about innovation.

Regular Italic 10pt /12

The Nintendo 64 also marked a transition in design identity. Its emphasis on analog control, four-player local multiplayer, and tightly curated first-party software distinguished it from competitors. Titles such as Super Mario 64 and The Legend of Zelda: Ocarina of Time became generational landmarks. In preservation discourse, these games symbolized the shift from sprite-based worlds to fully navigable 3D spaces, redefining expectations for console interactivity.

Light Italic 10pt /12

Sega's Saturn, launched earlier in Japan in 1994 and internationally in 1995, illustrates the complexities of brand fragmentation. Technically sophisticated yet notoriously difficult to program for, the Saturn struggled with third-party alignment outside Japan. Sega's abrupt strategic pivots and internal corporate restructuring weakened consumer confidence. This instability later amplified collector fascination, as the console came to represent a pivotal, transitional moment.

Extrabold 10pt /12

Brand fragmentation intensified as Sony's PlayStation consolidated dominance by the late 1990s. Its developer-friendly architecture and expansive software library contrasted sharply with both Nintendo's cartridge limitations and Sega's hardware complexity. Sony's branding emphasized maturity, cinematic storytelling, and global appeal. By 1998, market leadership had shifted decisively, reshaping competitive hierarchies.

Bold 10pt /12

By the end of the decade, console identity had diversified into distinct historical trajectories. Nintendo embodied curated continuity, Sega symbolized experimental volatility, and Sony represented scalable multimedia integration. These differentiated brand paths structured how later retro communities categorized and valued systems. Preservation culture increasingly organized itself around brand legacies, treating each console line as a coherent historical chapter within a rapidly maturing industry.

Semibold 10pt /12

Handheld consoles in the 1990s developed a distinct identity separate from home systems. Nintendo's Game Boy, launched in 1989 but dominant throughout the early 1990s, prioritized battery longevity and durability over color fidelity. Its monochrome screen became emblematic rather than limiting. Portability redefined gaming as personal and mobile, embedding devices into daily routines. This intimacy later intensified nostalgic attachment and strengthened preservation impulses.

Medium 10pt /12

The Game Boy's success stemmed not only from hardware design but from software continuity. Franchises such as Pokémon and The Legend of Zelda extended Nintendo's brand cohesion into portable form. Cartridges were physically small yet culturally expansive. Because handheld systems were frequently carried and handled, their material wear differed from home consoles. Scratched shells and faded labels became visible markers of lived experience within retro collecting.

Regular 10pt /12

Sega's Game Gear, released in 1990, pursued technological contrast through a full-color backlit display. Although visually impressive, it consumed batteries rapidly and lacked the same software ecosystem stability. Sega's portable strategy mirrored its broader brand identity: ambitious and technically bold, yet commercially inconsistent. In retrospect, the Game Gear's short-lived dominance reinforced its rarity and symbolic position within discussions of experimental hardware paths.

Light 10pt /12

Portable identity also altered the social dynamics of play. Unlike arcade cabinets or living room consoles, handheld devices facilitated private engagement. Gaming shifted from shared spectacle to individual immersion during commutes, school breaks, and travel. This change influenced memory formation. Nostalgia associated with handheld systems often centers on location and atmosphere—bus rides, bedrooms, summer afternoons—rather than solely on screen content.

Extrabold Italic 10pt /12

By the late 1990s, portable gaming had secured independent legitimacy within the broader console ecosystem. The emergence of incremental revisions, such as slimmer hardware models and color variants, foreshadowed future iterative product cycles. Preservation culture responded by cataloging model differences, regional packaging, and battery compartment revisions. Handheld systems thus became parallel archives of 1990s brand strategy, technological compromise, and intimate user experience.

Bold Italic 10pt /12

The early 1990s saw console manufacturers experiment with hardware extensions designed to prolong platform lifecycles. Sega's CD add-on for the Genesis introduced optical media capabilities while maintaining backward compatibility. Marketed as a technological leap, it promised cinematic full-motion video and enhanced audio. Yet its high cost and fragmented software support complicated brand clarity, illustrating the risks of layered hardware ecosystems & bionetwork.

Semibold Italic 10pt /12

The Sega 12X, released in 1994, intensified this fragmentation. Positioned as an intermediate upgrade between the Genesis and the forthcoming Saturn, it required additional cables and power supplies, creating physical and conceptual complexity. Consumers faced uncertainty regarding longevity and compatibility. Retrospectively, the 32X symbolizes transitional hardware anxiety, representing a moment when rapid innovation outpaced coherent branding strategy.

Medium Italic 10pt /12

Nintendo adopted a more restrained approach to expansion. Rather than pursuing extensive add-ons during the 16-bit era, it concentrated on tightly integrated peripherals such as the Super FX chip embedded within specific cartridges. This method preserved brand cohesion while incrementally enhancing graphical capability. From a preservation standpoint, embedded co-processors complicate emulation and documentation, underscoring the technical diversity hidden within outwardly uniform cartridges.

Regular Italic 10pt /12

Peripheral ecosystems also extended into controllers and interface devices. The introduction of analog sticks, rumble feedback, and light gun accessories expanded interaction paradigms. These devices shaped experiential memory and later influenced preservation challenges. Maintaining functional peripherals requires specialized components and calibration knowledge. Thus, hardware extensions are not marginal footnotes but integral parts of the 1990s console identity.

Light Italic 10pt /12

By the end of the decade, the lessons of expansion fatigue were clear. Fragmented add-ons risked diluting consumer trust and complicating developer support. Later console generations favored cleaner generational transitions rather than stacked upgrades. Within retro discourse, however, these peripheral experiments gained renewed interest. Their commercial instability translated into collectible rarity, reinforcing the appeal of transitional hardware artifacts.

Extrabold 10pt /12

Media format defined much of the 1990s technological debate. Cartridges offered durability and minimal load times but imposed storage constraints and higher manufacturing costs. CD-ROMs dramatically expanded capacity while lowering production expense, enabling cinematic presentation and extensive audio. This material divergence shaped design philosophy. Developers calibrated according to format limitations.

Bold 10pt /12

Arcade boards occupied yet another position within this ecosystem area. Unlike home consoles, arcade hardware prioritized performance consistency and commercial reliability. Custom boards often exceeded contemporary console capabilities but remained physically bulky and expensive. When cabinets entered private collections, preservation required understanding board revisions, region coding, and component sourcing.

Semibold 10pt /12

The shift from cartridge to optical disc also altered economic structures. Lower CD production costs encouraged broader third-party participation, accelerating software diversification on systems such as the PlayStation. Conversely, cartridge manufacturing centralized power among platform holders. These structural differences influenced market share and later shaped retro availability.

Medium 10pt /12

From a preservation perspective, each medium presents distinct vulnerabilities. Cartridges risk battery failure and plastic degradation. Optical discs suffer from disc rot and surface damage. Arcade boards face capacitor aging and monitor deterioration. The material fragility of each format reinforces the necessity of documentation and replication strategies. Preservation is therefore inseparable from media science.

Regular 10pt /12

By the late 1990s, format competition had effectively concluded in favor of optical media for mainstream consoles. Yet cartridges persisted in handheld systems, maintaining hybrid continuity. This coexistence reflects the decade's transitional character. Retro culture later interpreted the 1990s not merely as a technological race but as a laboratory of competing media philosophies.

Light 10pt /12

The pair hark back to the days of daggy, singing 'I just wanna go back, back to 1999/Take a ride to my old neighbourhood/ I just wanna go back, sing: 'hit me, baby, one more time', All while dressing up as Kate and Leo in the iconic *Titanic scene* (from 1997) on the ship's bow and celebrating the leather-clad hero Neo of The Matrix while working on their iMac desktop computer.

Extrabold Italic 10pt /12

Regional dynamics profoundly shaped 1990s console trajectories. In Japan, hardware lifecycles were often shorter and software libraries more experimental. Arcade culture remained robust, influencing home console design priorities. Meanwhile, North America emphasized mainstream retail distribution and aggressive marketing rivalries. Europe experienced staggered releases and localization delays.

Bold Italic 10pt /12

Japan's domestic market nurtured niche genres and hardware iterations rarely exported widely. Visual novels, rhythm prototypes, and specialized arcade conversions flourished within localized ecosystems. Consequently, collectors seeking completeness encountered region-locked catalogs. Import culture emerged as a bridge, introducing voltage converters, modified consoles.

Semibold Italic 10pt /12

North America's retail infrastructure prioritized blockbuster franchises and broad demographic appeal. Advertising campaigns framed console competition as cultural rivalry, reinforcing brand loyalty through televised and print media saturation. As a result, certain titles achieved iconic status disproportionate to their global reach. Preservation communities later revisited overlooked imports.

Medium Italic 10pt /12

Europe's PAL standard introduced technical divergence through differing refresh rates and resolution adjustments. Conversion processes occasionally altered gameplay speed and audiovisual timing. These subtle modifications became points of archival significance. Retro discourse increasingly acknowledged that identical titles might vary meaningfully across territories.

Regular Italic 10pt /12

By the late 1990s, globalization and online communication began reducing informational isolation between regions. Import reviews, fan translations, and cross-border trading fostered shared awareness. However, historical fragmentation remained embedded in hardware revisions and packaging differences. Preservation culture responded by categorizing releases geographically.

Light Italic 10pt /12

Marketing in the 1990s played a decisive role in shaping long-term brand memory. Television commercials, magazine spreads, and demo kiosks established emotional associations between hardware and lifestyle. Sega's confrontational tone contrasted sharply with Nintendo's family-oriented messaging, while Sony cultivated an aura of cinematic maturity. These identity constructions persisted beyond product lifecycles.

Extrabold 10pt /12

Print magazines functioned as both promotional channels and historical record. Reviews, preview columns, and hardware specifications provided structured documentation. Readers preserved issues as reference materials, inadvertently archiving release schedules and developer interviews. In retrospect, magazine culture forms a primary source corpus for reconstructing 1990s console discourse.

Bold 10pt /12

Advertising aesthetics also shaped visual memory. Bold typography, high-contrast layouts, and slogan-driven campaigns embedded specific visual languages into collective recall. When retro communities recreate 1990s design motifs, they often draw directly from these promotional materials. Thus, preservation extends beyond software and hardware to include graphic identity, packaging art, and retail display culture.

Semibold 10pt /12

By 1998, the cumulative impact of branding, regional variation, hardware experimentation, and media format competition had solidified the 1990s as a formative decade. Retro culture would later reconstruct this period through layered memories shaped as much by marketing narrative as by gameplay mechanics. The consoles themselves became symbols—compressed representations of technological ambition, and generational identity.

Medium 10pt /12

By 1998, the industry stood at the threshold of a generational transformation. Anticipation surrounding upcoming hardware emphasized processing power, DVD integration, and expanded 3D environments. Marketing language shifted toward realism, cinematic immersion, and network potential. This forward-looking rhetoric further distanced 1990–1994 consoles from contemporary innovation, accelerating their symbolic relocation.

Regular 10pt /12

Sega's Dreamcast, released in Japan in 1998 and internationally in 1999, embodied transitional ambition. It integrated online connectivity through built-in modem support, signaling early convergence between console gaming and internet infrastructure. Despite critical acclaim, commercial instability persisted. In retrospective discourse, the Dreamcast represents both culmination.

Light 10pt /12

Sony's consolidation of market dominance intensified expectations for the PlayStation successor. The promise of DVD playback and multimedia functionality redefined the console as a household entertainment hub rather than a specialized device. This repositioning reflected broader technological convergence occurring at the turn of the millennium. Consoles were no longer isolated gaming machines.

Extrabold Italic 10pt /12

Nintendo, preparing its next-generation system, faced strategic recalibration. The Nintendo 64's cartridge limitations had constrained third-party relationships. Lessons from this period influenced subsequent hardware decisions emphasizing optical media adoption. This transition illustrates how late-1990s competition reshaped long-term corporate philosophy. Preservation culture later interpreted these pivots.

Bold Italic 10pt /12

As the sixth generation emerged, the temporal boundary of the "retro" era began crystallizing. Systems once considered contemporary now appeared technologically distinct. The 1990s were increasingly framed as a completed chapter rather than an ongoing trajectory. Communities that had formed around troubleshooting and nostalgia in the early decade now occupied a different role.

Semibold Italic 10pt /12

The 1990s represent a formative decade in which video game culture transitioned from rapid technological expansion to historical self-awareness. What began as generational hardware competition gradually evolved into a layered ecosystem of documentation, preservation, and brand identity construction. Nostalgia did not emerge suddenly; it developed alongside obsolescence, shaped by accelerating innovation cycles.

Medium Italic 10pt /12

Console brands structured memory through distinct philosophies. Nintendo emphasized continuity and controlled evolution, Sega embodied experimental volatility, and Sony introduced scalable multimedia integration. These divergent strategies produced parallel historical narratives that later organized retro discourse. Collectors and archivists did not simply preserve hardware; they preserved brand trajectories.

Regular Italic 10pt /12

Gen Z, who were born between 1997 and 2012, are "specifically captivated by what life was like in the analogue past", wrote Routledge, and they seem to be "mining" it to "enrich their present lives", particularly by "fostering a greater appreciation for offline living". "At some point" during the past 15 years, wrote Daisy Dunn in The Spectator, "it was decided that the 1990s were a golden age".

Light Italic 10pt /12

Media format competition further defined the decade's archival complexity. Cartridges, optical discs, and arcade boards each imposed material constraints and preservation challenges. These differences shaped design aesthetics, economic models, and long-term availability. As formats aged differently, retro communities developed specialized technical literacies. Preservation thus became an interdisciplinary practice.

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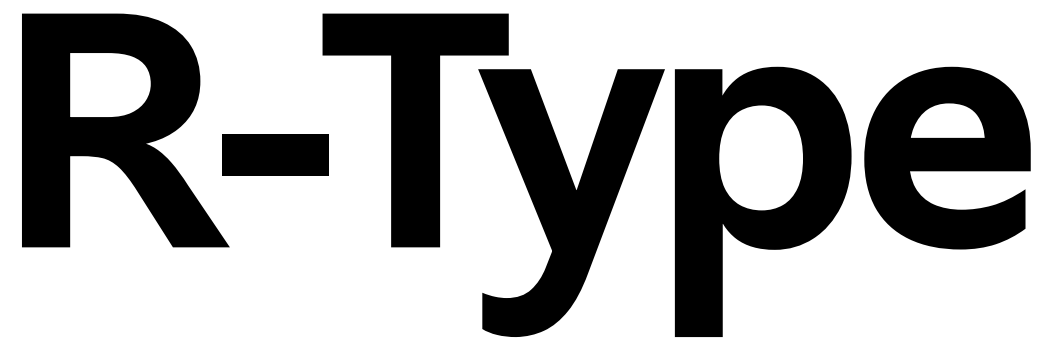

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Area III

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Finalfight

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Teenage Mut

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ChampionshipvBall

90pt

Bitmap

40pt /44

The Bitmap Brothers is a British video game

30pt /33

Founded in 1987 by Mike Montgomery, Eric Matthews, and Steve Kelly. The company released its first title.

22pt /25

Shortly thereafter, it released *Speedball*. Prior to publishing its own games (as Renegade Software), early Bitmap Brothers titles were distributed by Image Works.

18pt /21

The Bitmap Brothers released several games on the Amiga, Atari ST, and other DOS machines. The company came to prominence partly because it developed many different types of games , and most of these titles became highly regarded.

16pt /20

The Bitmap Brothers' PC games have never matched the sales of their previous Amiga titles, however, even despite garnering positive critical reviews in the press. Frequently characterized as rockstars, Montgomery, Matthews, and Kelly once posed in dark sunglasses next to Robert Maxwell's helicopter. Maxwell owned Mirrorsoft, the publisher of a number of their games. After 2002, the company released ports of several of their games for both the Game Boy Advance and Pocket PC. Since then, it has been licensing its older games to several other companies.

14pt /18

The Bitmap Brothers was based in Wapping, East London and was privately owned. The company's managing director was Mike Montgomery, who founded the company together with Eric Matthews and Steve Kelly. Montgomery later went on to take sole control of the business. Mark John Coleman is a computer graphics developer who frequently worked with The Bitmap Brothers and, along with Dan Malone, was responsible for the visual style.

11pt /14

The Bitmap Brothers became known for the high difficulty of their games. Montgomery later remarked that "all of the Bitmap Brothers games... they're probably a bit too difficult. The reason for that was we designed games that we wanted to play - for us it was actually quite hard.

10Opt /12

In a 2024 interview with video game documentarian Danny O'Dwyer, Charles Cecil of fellow British video game developers Revolution Software recalled an interaction between The Bitmap Brothers and American video game publisher Acclaim Entertainment. After the death of Robert Maxwell and various financial troubles.

8pt /10

Multiple companies previously owned by Mirrorsoft, such as The Bitmap Brothers and Revolution Software, consequently sought to terminate their contracts but were met with resistance from Acclaim. Acclaim sent letters to these companies expressing dissatisfaction with the companies' intentions to terminate their respective partnerships. According to Cecil, the letters ended with two checkboxes: one for "YES" to acknowledge and accept continued partnership with Acclaim, and one for "NO". The Bitmap Brothers allegedly wrote in a third option for "FUCK OFF," marked it, and returned the letter.

6pt /8

Business Development Director, Ed Bartlett went on to pioneer the in-game advertising industry, initially with Hive Partners and then with IGA Worldwide. After years of silence, a news post on The Bitmap Brothers' official website announced *Speedball 2 Tournament*. *Speedball 2 Tournament* was released in November 2007 by Frogster Interactive but failed to achieve the success of previous titles in the franchise. In October 2010, it was announced that Speedball 2 would be released for the iPhone and iPad, with Vivid Games managing the port. A mobile version of Z was developed by Peter Harrap and TickTock Games. It was published by KavCom in 2011 initially for iOS, utilizing a touch-screen control scheme. The port was then released on BlackBerry Playbook, Android, and Kindle in 2012. The mobile version remake by TickTock Games was also released for Mac in 2012, and then published by Kiss Ltd and KavCom for Windows PC on Steam and GOG.com on 4 July 2014.

90pt

Dreamcast

40pt /44

The final home video game console by Sega.

30pt /33

It was released in Japan on November 27, 1998, and world-wide in late 1999. It succeeded the Sega Saturn.

22pt /25

A team led by Hideki Sato began developing the Dreamcast in 1997. In contrast to the expensive hardware of the unsuccessful Saturn, the Dreamcast was designed

18pt /21

costs with off-the-shelf components, including a Hitachi SH-4 CPU and an NEC PowerVR2 GPU. The Dreamcast shared hardware with Sega's NAOMI system board, enabling authentic arcade game conversions. Sega used the GD-ROM disc format.

16pt /20

Developers could use a custom version of Windows CE for easier PC game porting. The Dreamcast was the first console to include a built-in modular modem for internet access and online play. Though its Japanese release was beset by supply problems, the Dreamcast had a successful US launch backed by a large marketing campaign. However, sales steadily declined as Sony built anticipation for the PlayStation 2. Dreamcast sales did not meet Sega's expectations, and attempts to renew interest through price cuts caused significant financial losses.

14pt /18

After a change in leadership, Sega discontinued the Dreamcast on March 31, 2001, and restructured itself as a third-party developer. 9.13 million Dreamcasts were sold worldwide and over 600 games were produced. Sega subsequently ported many Dreamcast games to other platforms. The Dreamcast's commercial failure has been attributed to several factors, including competition from the PlayStation 2, limited third-party support, and the earlier failures of the 32X and Saturn having tarnished Sega's reputation.

11pt /14

In retrospect, reviewers have celebrated the Dreamcast as one of the greatest consoles. It is considered ahead of its time for pioneering concepts such as online play and downloadable content. Many Dreamcast games are regarded as innovative, including *Sonic Adventure* (1998), *Crazy Taxi* (1999), *Shenmue* (1999).

10pt /12

The Dreamcast remains popular in the video game homebrew community, which has developed private servers to preserve its online functions and unofficial Dreamcast software. In 1988, Sega released the Genesis (known as the Mega Drive), in the fourth generation of video game consoles. It became the most successful Sega console ever, at 30.75 million units sold.

8pt /10

The Dreamcast measures 190 mm × 195.8 mm × 75.5 mm (7.48 in × 7.71 in × 2.97 in) and weighs 1.5 kg (3.3 lb). Its main CPU is a two-way 360 MIPS superscalar Hitachi SH-4 32-bit RISC, clocked at 200 MHz with an 8 kB instruction cache and 16 kB data cache and a 128-bit graphics-oriented floating-point unit delivering 1.4 GFLOPS. Its 100 MHz NEC PowerVR2 rendering engine, integrated with the ASIC, can draw more than 3 million polygons per second and use deferred shading. Sega estimated the Dreamcast's theoretical rendering capability at 7 million raw polygons per second, or 6 million with textures and lighting.

6pt /8

Sega announced that Shoichiro Irimajiri would replace Tom Kalinske as chairman and CEO of Sega of America, while Bernie Stolar, a former executive at Sony Computer Entertainment of America, became Sega of America's executive vice president in charge of product development and third-party relations. After the 1996 launch of the Nintendo 64, sales of the Saturn and its software fell sharply. As of August 1997, Sony controlled 47 percent of the console market, Nintendo controlled 40 percent, and Sega controlled only 12 percent; neither price cuts nor high-profile games helped the Saturn. Hayao Nakayama resigned as president of Sega in January 1998 in favor of Irimajiri, and Stolar became CEO and president of Sega of America. Following five years of generally declining profits, in the fiscal year ending March 31, 1998, Sega suffered its first parent and consolidated financial losses since its 1988 listing on the Tokyo Stock Exchange, reporting a consolidated net loss of ¥35.6 billion (US$269.8 million).

90pt

Cadillacs

40pt /44

and Dinosaurs (video game)

30pt /33

***Cadillacs and Dinosaurs*, released in Japan as *Cadillacs Kyouryuu Shinseiki* in 1993. Side-scrolling beat 'em up.**

22pt /25

The game was produced as a tie-in to the short-lived *Cadillacs and Dinosaurs* animated series which was aired during the same year the game was released.

18pt /21

Up to three players can play at once, guiding their selected characters through eight stages, battling various enemies and bosses. There are four playable characters, each with their own strengths and weaknesses: Jack (balanced type), Hannah (skill type) etc.

16pt /20

The game's titular dinosaurs make appearances as neutral characters that may attack both player characters and enemies. The players have access to several attacks. Each character has two special moves including one that depletes a character's health upon contact with an enemy and when two or more players play together, they can trigger a team-attack. Players can also find and use various firearms, throwing weapons such as rocks and explosives, and melee weapons such as clubs. When the player loses along the way, one of the big baddies holds a gun point-blank to the losing player.

14pt /18

The story begins in the 26th century, when an ensemble gang called the Black Marketeers begin hunting the dinosaurs to serve their unknown purpose. The continuous hunting process has made the dinosaurs violent and now they have started attacking villages and people. Four heroes: mechanic and shaman Jack Tenrec, diplomat and explorer by profession Hannah Dundee, Jack's friend and engineer Mustapha Cairo, and mysterious Mess O'Bradovich.

11pt /14

The protagonists journey to the "City in the Sea' where they suspect the whole hunting network being operating from. As they reach the top of a building Vice orders his men to attack the group but they fight Vice Terhune. After being beaten, Vice tells them about Butcher.

10pt /12

Meanwhile, another big name in the hunting network, Hogg, realizes that Jack is busy in the swamp forest and decides to take over Jack's Garage. Proceeding with the mission, the heroes go through the desert of death, where they use their car to travel safely, but then the car is chased by Hogg on his cruiser motorcycle. After defeating Hogg.

8pt /10

This is when they receive a message from an old villager who tells them about the weird behavior of the dinosaurs and asks for help. In response to the call, the heroes reach the village where they notice dinosaurs violently attacking the people and that the village has been set on fire by someone. Going ahead further, they meet the old villager again as he tells about the whole network and as soon as he is about to reveal the name of the person behind all of it, he is shot dead by Morgan, who attacks the group as well. During the fight, Morgan talks about the powers of "doctor" transforms himself into a dinosaur

6pt /8

Proceeding ahead, the heroes reach the coal mine and another jungle, where they face a dinosaur trying to stomp them. They eventually reach a place where they fight a tentacled creature called Tyrog that attaches itself to the bodies of the gangsters as a monstrous dinosaur-human hybrid. With all the leads and hints, Jack has now realized that Dr. Simon Fessenden is the mastermind behind all that is happening. The team heads towards his underground hideout, which again is somewhere in the "City in the Sea". The heroes head towards the bunker, going through the library and the computer lab, where the doctor appears on the computer screen, calling himself the creator of a new world. Deep down is a bio-lab, and below it is a cave, which finally leads to Fessenden's lab. Seeing the team, he transforms himself into a Morgue-like creature, but is beaten. By now, the transforming serum's effect reaches its peak, and Fessenden transforms into a three-headed creature, but the heroes manage to defeat him.

90pt

Sonic

40pt /44

Sonic Adventure is a 1998 platform game.

30pt /33

Developed by Sonic Team and published by Sega for the Dreamcast. It was the first main *Sonic the Hedgehog* game.

22pt /25

It follows Sonic the Hedgehog, Miles “Tails” Prower, Knuckles the Echidna, Amy Rose, Big the Cat, and E-102 Gamma in their quests to collect the Chaos Emeralds.

18pt /21

Controlling one of the six characters—each with their own abilities—players complete levels to progress the story. Sonic Adventure retains many elements from prior Sonic games, such as power-ups and the ring-based health system.

16pt /20

Sonic Adventure is a 3D platform game with action and role-playing elements. Players control one of six anthropomorphic protagonists as they venture to defeat Doctor Robotnik and his robot army, who seeks the seven Chaos Emeralds and the entity Chaos. Six player characters are unlocked as the game progresses, each with their own story and attributes. Sonic the Hedgehog performs a spin dash, homing attack, and light-speed dash; Miles "Tails" Prower flies, swims, and attacks robots using his tails; Knuckles the Echidna glides, climbs walls, and punches.

14pt /18

At the start of the game, the player is placed in one of three Adventure Fields, open-ended hub worlds inhabited by advice-giving NPCs. The player is guided and instructed by the voice of Tikal the Echidna. Through exploration, the player discovers entrances to levels called Action Stages, some of which must be opened using keys hidden in the Adventure Field. Once the player accesses an Action Stage, they are tasked with a specific objective, which is different for each character.

11pt /14

The mad scientist Doctor Robotnik seeks a new way to defeat his nemesis, Sonic, and conquer the world. He learns about Chaos, a creature that, thousands of years ago, helped to protect the Chao and the all-powerful Master Emerald, which balances the power of the seven Chaos Emeralds.

10pt /12

After police fail to defeat Chaos, Sonic and Tails work to stop Robotnik from empowering it with the Chaos Emeralds. Knuckles, the only remaining echidna, sets out to find the shards of the Master Emerald. Robotnik activates a new series of robots, including E-102 Gamma, and orders them to find Froggy, a frog who ate a Chaos Emerald; Froggy's owner.

8pt /10

During the early 1990s, Sega was one of the most successful video game companies due to the rise of its Genesis console. Genesis sales were driven by the popularity of Sega's flagship franchise of 2D platform games, Sonic the Hedgehog. During this time, series co-creator Yuji Naka worked with Sega Technical Institute (STI) in the United States to develop Sonic games. After the completion of Sonic & Knuckles in 1994, Naka returned to Japan to work with Sonic Team. STI began developing Sonic X-treme for the Sega Saturn, planned as the first Sonic the Hedgehog game to feature full 3D gameplay.

6pt /8

Sonic Team felt challenged by the new hardware to recreate Sonic and his world in a new way. They began development using the character designs from the Genesis games, but quickly discovered the characters' bodies were too short and their heads too big, making them difficult to see. Retro game characters, such as Pac-Man, were also being reborn in a more "urban" fashion around the same time, something that made Sonic Team jealous and feel the original character designs were dated. As such, Yuji Uekawa redesigned each character to suit the transition to 3D and to give them "new, edgy, more Western" design. Looking to the animation of Walt Disney and Looney Tunes for inspiration, he made Sonic more mature, taller and slimmer, and gave him longer quills. He darkened his blue color and gave him green irises to contrast with the rest of his color scheme, as well as reference Green Hill Zone. Uekawa tried to make Sonic look like a comic book character and compared the style to graffiti. cters fit this new art style.

90pt

Game Card

40pt /44

A Nintendo Game Card is a physical flash storage card.

30pt /33 ☑ **Alternate 'a' (SSO1)**

They are the successor to the ROM cartridge-based Game Boy Game Paks used in Nintendo's previous handheld game.

22pt /25

Game cards for the Nintendo DS range from 8 to 512 megabytes in capacity. The cards contain an integrated flash memory for game data and an EEPROM.

18pt /21

It has been mentioned that larger (>64 MB) cards had a 25% slower data transfer rate; however, the specific base rate is unknown. Many Nintendo DS titles released after the launch of the Nintendo DSi in 2008 include features that enhance gameplay.

16pt /20

DSi console. Most of these games are compatible with the older DS models. However, a select few retail game titles were released that worked exclusively for the Nintendo DSi consoles for reasons such as requiring camera functions. These titles have game cards with white-colored casings. While these game cards can be physically inserted into original Nintendo DS consoles, their software does not function due to the missing hardware features and will display an error message. These DSi-exclusive game cards are fully compatible with the Nintendo 3DS family.

14pt /18

The author was Joen Petri Klint, a priest in diocese of *Linköping*, Sweden. In February 1602 a priest and two farmers were on their way home from the Candelmass market in Västergötland. A maid asked to go along. At an inn they got off to get a bite to eat, and the maid wanted something to drink, a jug of beer. The first time the innkeeper fetched beer, the jug was filled with malt, second time acorns, and finally blood. They were then horrified. The maid explained that this year will yield much grain.

11pt /14

Despite all iterations of the Nintendo DS line lacking native infrared support, certain titles made use of this type of communication function using game cards with their own infrared transceiver. These game cards are darker colored than regular DS/DSi game cards, and reveal their translucency.

10pt /12

Examples of game cards with infrared support include *Personal Trainer: Walking* and *Active Health With Carol Vorderman*, which connect to the included pedometers, Pokémon HeartGold and SoulSilver, which connect to the included Pokéwalker accessory, and *Pokémon Black and White* and *Pokémon Black 2* and *White 2*, which connect DS systems facing each other.

8pt /10

The Nintendo 3DS uses a recovery measure that can boot into specific Nintendo DS/DSi flash cartridges instead of its built-in firmware, which was used to restore bricked systems with corrupted or damaged firmware or NAND flash. Hackers and modders have found a way to exploit this approach, allowing homebrew and other unsigned software to run reliably on any system regardless of the software version, as well as for installing custom firmware. Game cards for the Nintendo 3DS are from 1 to 4 gigabytes in size, with 2 GB of game data at launch. Though it was reported storage options range up to 8 GB, no game cards >4 GB.

6pt /8

While the New Nintendo 3DS accepts all game cards for the 3DS, there are a small number of game titles that were released on game cards that took advantage of the handheld's upgraded hardware. They looked identical in appearance to standard 3DS game cards and can be physically inserted into original 3DS/3DS XL systems, but are incompatible and will display an error message, similar to DSi-exclusive game cards. Game cards for the Nintendo Switch can have capacities of 1 GB, 2 GB, 4 GB, 8 GB, 16 GB and 32 GB in size. There were plans to introduce 64 GB game cards by the second half of 2018, however this was pushed back several times throughout the Switch's lifespan. Ultimately, they never ended up being available for the Switch, but it did end up being available for the Nintendo Switch 2, its successor released nearly eight years later. Again, due to their small size, Nintendo Switch 2 game cards are coated with denatonium benzoate, a non-toxic bitterant, as a safety precaution against accidental or deliberate consumption by young children.

90pt

Brawler64

40pt /44

[model numer: NUS-005] standard game controller

30pt /33

Manufactured and released by Nintendo, it debuted alongside the console in Japan on June 23, 1996, followed by North America.

22pt /25

As the successor to the Super Nintendo controller, it features an “M”-shaped design, ten buttons, a “control stick”, a D-pad, and a rear port for connecting accessories.

18pt /21

The controller was designed by Nintendo R&D3, under direction to try new ideas that would break from typical game controllers. With original visual designs having been mocked up in clay form, and extensive test group studies being performed before and during the design.

16pt /20

The Nintendo 64's controller design was eventually solidified in tandem with that of Shigeru Miyamoto's gameplay mechanics in Super Mario 64. Though Miyamoto tested the controller while developing Super Mario 64, the controller was not designed around the game, while it did influence its mechanics like movement. Nintendo of America's head designer, Lance Barr, said that the design studies revealed that most games use a few buttons for most of the main controls, such as jumping and shooting, or accelerating and braking. That's why the A and B Buttons are placed for easiest access on the new controller.

14pt /18

The controller has four "C-buttons" on the top, which were originally intended to control the camera in three-dimensional game environments. Because the pad only contains three other face buttons, the C-buttons may be assigned to alternate functions. In *The Legend of Zelda: Ocarina of Time*, three of the C-buttons can be assigned to secondary items, the upper C-button is used to call Navi for assistance, and the Z-trigger is used to lock focus onto enemies and center the camera behind the player.

11pt /14

The Nintendo 64 controller was among the first to feature a "control stick" as a central component, intended to provide the user with a wider range of functions such as mobility and camera control. Unlike a D-pad, which detect only 8 directions, this stick could register 360 degrees of movement.

10pt /12

While joysticks had long been used in gaming—appearing in the Atari 5200, Sega's arcade systems and Mission Stick for the Saturn (1995), and Sony's PlayStation Analog Joystick (1996)—the Nintendo 64 distinguished itself by using a thumb-operated stick. Previously, the only console accessory to feature a thumbstick was the Mega Drive's XE-1 AP.

8pt /10

Though functionally similar to an analog stick, the "control stick" is digital. It operates like a ball mouse, turning a chopper wheel wheel that interrupts a light beam detected by a photodiode. Its precision makes it effectively equivalent to a true analog stick. Since it registers only relative movement, the system assumes the stick is centered at startup. If misaligned, recalibration can be performed by pressing the L and R shoulder buttons along with the Start button or by restarting the console with the stick properly centered. The controller was designed to be held in three different positions. First, it can be held by the two outer grips.

6pt /8

Allowing use of the D-pad, right-hand face buttons and the L and R shoulder buttons (but not the Z-trigger or analog stick). This style was intended to optimize play in 2D games by emulating the setup on the Super NES controller. It can be also held by the center and right-hand grip, allowing the use of the single control stick, the right hand buttons, the "R" shoulder button, and the Z-trigger on the rear (but not the L shoulder button or D-pad). This style was intended for 3D games. Finally, the controller can be held by the center and left-hand grip, allowing for a combination of the D-pad, L shoulder, analog stick, and Z-trigger, as was implemented in *GoldenEye 007*. In some games such as *Mortal Kombat Trilogy*, the control stick and directional pad are interchangeable. Very few games use the directional pad exclusively, such as *Tetrisphere*, *Mischief Makers* and *Kirby 64: The Crystal Shards*. Additionally, though the controller was not designed with this setup in mind, one controller can be held in each hand with a thumb on each analog stick and index fingers on the Z-trigger.

90pt

Gameplay

40pt /44

The term applies to video games.

30pt /33

Gameplay is the connection between the player and the game, the player's overcoming of challenges.

22pt /25

Arising alongside video game development in the 1980s, the term gameplay was initially used solely within the context of video games.

18pt /21

There is no consensus on the precise definition of gameplay. It has been differently defined by different authors, but all definitions refer to player interaction with a game. For example: "The structures of player interaction with the game system and with other players".

16pt /20

Gameplay can be divided into several types. For example, cooperative gameplay involves two or more players playing together, often on a team. Playability is a measure of the quality of gameplay. Playability represents the ease, quantity, or duration that a game can be played. Playability evaluative methods target games to improve design, while player experience evaluative methods target players to improve gaming. Different scholars analyze playability according to different sets of criteria. For example, in Playability: satisfaction, learning, efficiency.

14pt /18

Heuristics have become an accepted and widely used ad-junct method of usability evaluation in Internet and soft-ware development. This report introduces HeuristicEvaluation for Playability (HEP), a comprehensive set ofheuristics for playability, based on the literature on pro-ductivity and playtesting heuristics that were specificallytailored to evaluate video, computer, and board games.These heuristics were tested on an evolving game.

11pt /14

These heuristics were tested on an evolving game designto assess their face validity and evaluation effectivenesscompared to more standard user testing methodologies.The results suggest that HEP identified qualitative simi-larities and differences with user.

10pt /12

The four game heuristic categories are defined as the fol-lowing: game play is the set of problems and challenges auser must face to win a game; game story includes all plotand character development; game mechanics involve theprogramming that provides the structure by which unitsinteract with the environment.

8pt /10

Nielsen developed a list of heuristics that were aimedfor use in productivity software. Software productivitystudies by Desurvire, et al. demonstrated the effec-tiveness of these heuristics when combined with user stud-ies. In game development, there is a need to develop acorresponding set of heuristics. Thus far, game heuristicshave been developed by several individuals, groups, andprofessionals in the game industry, and researchers in theHCI community. Since 2001, game designers Falsteinand Barwood have been writing the first of 400 rules ofgame design.

6pt /8

Asynchronous multiplayer is a form of multiplayer gameplay where players are not necessarily playing at the same time. This form of multiplayer game has its origins in play-by-mail games, where players would send their moves through postal mail to a game master, who then would compile and send out results for the next turn. Play-by-mail games transitioned to electronic form as play-by-email games. Similar games were developed for bulletin board systems, such as Trade Wars, where the turn structure may not be as rigorous and allow players to take actions at any time in a persistence space alongside all other players, a concept known as sporadic play. These types of asynchronous multiplayer games waned with the widespread availability of the Internet which allowed players to play against each other simultaneously, but remains an option in many strategy-related games, such as the Civilization series. Coordination of turns are subsequently managed by one computer or a centralized server.

90pt

Bryce3D

40pt /44

is a 3D modeling, rendering and animation

30pt /33

The name is taken from Bryce Canyon—a rugged region with many of the same landscapes that were first simulated.

22pt /25

The original Bryce software arose from work with fractal geometry to create realistic computer images of mountain ranges and coastlines.

18pt /21

An initial set of fractal based programs were developed by Ken Musgrave (who later created MojoWorld), a student of Benoît Mandelbrot, and extended by Eric Wenger. Wenger later met and worked with software artist Kai Krause.

16pt /20

The first commercial version, Bryce 1.0, appeared in 1994 for the Macintosh. Bryce 2.0, shipped in 1996, included much beyond the original notion of creating a realistic mountain range. These included independent light sources, complex atmospheric effects, the addition of primitive forms with Boolean methods to combine them, a revamped Texture Editor and the ability to export models to DXF. Bryce 2.0 was also ported to the Windows platform, although the first stable version, 2.1, was not released until 1997.

14pt /18

The ability to animate a scene was added (in a stable form) with the cross-platform Bryce 3D (version 3.1) in 1997 by the newly formed MetaCreations Corporation. A "camera object" unseen in the final image acted as the observer. The camera can be held in one place for a single image, or sent on a trajectory with images being rendered at many locations. The collection of images created along the camera's trajectory are combined.

11pt /14

In 1999 Bryce 4.0 was released with major improvements in the handling of atmospheres and skies, textures and also in the import/export of objects. In 2000 Bryce was purchased by Corel Corporation. Corel released version 5 of Bryce in 2001.

10Opt /12

Unfortunately, rendering on version 5 was much slower than version 4, and the price tag set by Corel higher. Soon followed a patch to version 5.01, which fixed some bugs and added a few undocumented features. In 2004, the software was sold again, to Daz 3D. In 2005, Daz 3D released Bryce 5.5 which included the Daz Studio Character plugin.

8pt /10

This integration between DAZ's application for the manipulation of 3D models, Daz Studio, and Bryce allowed users to import content from Daz Studio and Poser, complete with all materials including transparencies, directly into Bryce, thus making it easier to have human figures in Bryce scenes. In October 2006, Daz 3D released Bryce 6.0 and has released an update (6.1), this includes a Mac Intel compatible update. New features include animation import, support for dual-processor systems as well as hyper-threading, random replicate tool, advanced terrain editing.

6pt /8

In June 2007, Daz 3D re-released Bryce 5.5 as a freeware. In Summer 2009, Daz 3D released version 3 of Daz Studio. This version seemed to break Bryce 6.1. In December 2009, Daz 3D released Bryce 6.3 which improved stability, and added support for Mac OS X v10.6. Bryce 7 was released in July 2010. New features include the Instancing Lab and advanced lighting. Updated features include the Daz Studio Bridge, the Sky Lab, clouds and HDRI. Bryce 7 is available in three versions, a limited free version, a standard version lacking the new features and a pro version with the new features. Bryce 7 is not currently compatible with OS X Lion (10.7), Mountain Lion (10.8), or Mavericks (10.9) (except for Bryce 7 Personal Limited Edition 7.1.0.74), thus the newest version of OS X it is compatible with is Snow Leopard (10.6). As late as October 2018, Bryce 7 development has been halted, including macOS compatibility issues. Construction Set and all programs that support Nova Design's "Magic" protocol.

90pt

Midway

40pt /44

American video game company [1958–2010]

30pt /33

Midway's franchises included *Mortal Kombat, Rampage, Spy Hunter, NBA Jam, Cruis'n and NFL Blitz*.

22pt /25

The company was founded as Midway Manufacturing in 1958, as an amusement game manufacturer. The company was then purchased by Bally Manufacturing in 1969.

18pt /21

In 1973, Midway moved into the interactive entertainment industry, developing and publishing arcade video games. The company scored its first mainstream hit with the U.S. distribution of Taito's *Space Invaders* in 1978

16pt /20

Which it followed up by licensing Namco games such as *Galaxian* (1979), *Pac-Man* (1980), and *Galaga* (1981). Bally then consolidated its pinball division with Midway in 1982, which was renamed Bally Midway. In 1988, Bally Manufacturing sold its amusement games operations to WMS Industries, the former Williams Electronics, which used the plain Midway name for video games while using the Bally and Williams names for pinball. In 1994, WMS purchased Tradewest to bring publishing of home video game market in-house, with the latter becoming Midway.

14pt /18

Midway exited the arcade industry in 2001. Sumner Redstone, head of Viacom and CBS Corporation, increased his stake in Midway from about 15% in 1998 to about 87% by the end of 2007. In December 2008, Redstone sold all his stock and $70 million of Midway debt to private investor Mark Thomas for $100,000. In February 2009, Midway Games filed for Chapter 11 bankruptcy. Warner Bros. Interactive Entertainment acquired most of the company's assets.

11pt /14

Midway Mfg. Co. began in 1958 as an independent manufacturer of amusement equipment founded by Henry Ross and Marcine Wolverton. It was purchased by Bally in 1969. Bally, at that time, was a leader in the manufacture of slot machines.

10pt /12

After some years making mechanical arcade games such as puck bowling and simulated western shoot-out, Midway became an early American maker of arcade video games. Throughout the 1970s, Midway had a close alliance with Japanese video game publisher Taito, with both companies regularly licensing their games to each other.

8pt /10

Meanwhile, Midway's breakthrough success came in 1978, with the licensing and distribution of Taito's seminal arcade game Space Invaders in America. This was followed by Midway's licensing and distributing the U.S. version of Namco's *Pac-Man* in 1980, and its sequel, *Ms. Pac-Man*, in 1982. Also in 1982, Midway became Bally Midway Mfg. Co. after Bally merged its pinball division with Midway. Three games released that year, including Satan's Hollow, were the first to feature the Bally/Midway brand. From the late 1970s through the late 1980s, Midway was the leading producer.

6pt /8

Under WMS ownership, Midway initially continued to produce arcade games under the Bally/Midway label, while producing pinball machines under the "Bally" brand. In 1991, however, Midway absorbed Williams' video game division and stopped using the "Bally/Midway" label for its arcade games. In 1992, the company's The Addams Family machine became the best selling pinball game of all time. In 1996, WMS purchased Time Warner Interactive, which included Atari Games, originally a part of Atari, Inc. Also in 1996, Midway changed its original corporate name, Midway Manufacturing, to Midway Games Inc., due to its entrance in the home console market. This was facilitated by WMS transferring its former home console division, Williams Entertainment, Inc., to Midway. The division had previously been known as Tradewest, which WMS had acquired along with its subsidiary Leland Corporation in 1994. The original arcade division of the company became Midway Amusement Games.

90pt

Cellular

40pt /44

A cellular network or mobile network

30pt /33

Where the link to and from end nodes is wireless and the network is distributed over land areas called *cells*.

22pt /25

These base stations provide the cell with the network coverage which can be used for transmission of voice, data, and other types of content via radio waves.

18pt /21

Each cell's coverage area is determined by factors such as the power of the transceiver, the terrain, and the frequency band being used. A cell typically uses a different set of frequencies from neighboring cells, to avoid interference.

16pt /20

When joined, these cells provide radio coverage over a wide geographic area. This enables numerous devices, such as mobile phones, tablets, laptops equipped with mobile broadband modems, and wearable devices such as smartwatches, to communicate with each other and with fixed transceivers and telephones anywhere in the network, via base stations, even if some of the devices are moving through more than one cell during transmission. The design of cellular networks allows for seamless handover, enabling uninterrupted communication when a device moves.

14pt /18

Major telecommunications providers have deployed voice and data cellular networks over most of the inhabited land area of Earth. This allows mobile phones and other devices to be connected to the public switched telephone network and public Internet access. In addition to traditional voice and data services, cellular networks now support internet of things (IoT) applications, connecting devices such as smart meters, vehicles, and industrial sensors.

11pt /14

The evolution of cellular networks from 1G to 5G has progressively introduced faster speeds, lower latency, and support for a larger number of devices, enabling advanced applications in fields such as healthcare, transportation, and smart cities.

10pt /12

Private cellular networks can be used for research or for large organizations and fleets, such as dispatch for local public safety agencies or a taxicab company, as well as for local wireless communications in enterprise and industrial settings such as factories, warehouses, mines, power plants, substations, oil and gas facilities and ports.

8pt /10

In a cellular radio system, a land area to be supplied with radio service is divided into cells in a pattern dependent on terrain and reception characteristics. These cell patterns roughly take the form of regular shapes, such as hexagons, squares, or circles although hexagonal cells are conventional. Each of these cells is assigned with multiple frequencies (f1 - f6) which have corresponding radio base stations. The group of frequencies can be reused in other cells, provided that the same frequencies are not reused in adjacent cells, which would cause co-channel interference.

6pt /8

First-generation cellular network technology continued to expand its reach to the rest of the world. In 1990, Millicom Inc., a telecommunications service provider, strategically partnered with Comvik's international cellular operations to become Millicom International Cellular SA. The company went on to establish a 1G systems foothold in Ghana, Africa under the brand name Mobitel. In 2006, the company's Ghana operations were renamed to Tigo. The wireless revolution began in the early 1990s, leading to the transition from analog to digital networks. The MOSFET invented at Bell Labs between 1955 and 1960, was adapted for cellular networks by the early 1990s, with the wide adoption of power MOSFET, LDMOS (RF amplifier), and RF CMOS (RF circuit) devices leading to the development and proliferation of digital wireless mobile networks. The first commercial digital cellular network, the 2G generation, was launched in 1991.

90pt

32-Bit Wars

40pt /44

and 3D Revolution (1995–2005)

30pt /33

Picture this: it’s 1995. Arcades are still buzzing, but something seismic is happening in living rooms worldwide.

22pt /25

The pixelated sprites we grew up with are morphing into fully realized 3D worlds. Cartridges are giving way to shiny CDs. And gaming?

18pt /21

This was the 32-bit era, a decade where gaming didn’t just evolve, it reinvented itself. We went from flat, side-scrolling adventures to sprawling 3D landscapes where you could run, jump, and explore in ways that felt real.

16pt /20

The mid-’90s were a battleground. Three bold consoles — Sega Saturn, Sony PlayStation, and Nintendo 64 — each with their own vision, slugged it out to define who would own the living room. Each console brought something dramatically different to the table. Sony’s PlayStation launched at £299 with a 32-bit processor focused entirely on 3D gaming via CD-ROM. Nintendo’s N64 arrived a year later at £249, sporting a 64-bit processor but sticking with cartridges. Sega’s Saturn came in at £399, attempting to bridge 2D arcade perfection with emerging 3D capabilities.

14pt /18

The winner wasn’t just the most powerful box, but the one smart enough to speak to what gamers really wanted: diverse experiences, accessible pricing, and a future to believe in. By the millennium, it wasn’t even close. Sony’s PlayStation captured over 50% of the market by 1998, while Nintendo held strong at 35-38%. Sega’s Saturn faded to single digits, and their last-ditch effort — the innovative Dreamcast — could only muster 10% despite being years.

11pt /14

Sony came from left field, and that was exactly their power. No “gaming heritage” meant they saw no rules to break, just possibilities. Sony’s “entertainment-first” mindset showed in everything: from the CD drive and high-quality audio to a memorable ad campaign.

10pt /12

They blended strong technology with cinematic vision — the R3000 CPU, custom graphics chip, and 24-channel ADPCM sound came together for silky-smooth 3D, gorgeous audio, and those FMV cutscenes that wowed us all. They offered cheaper media (£0.50 per disc vs. £8-12 per cartridge), accessible dev kits (£2,500 vs. £15,000 for N64), and dramatically lower licensing fees (9% vs. 23%).

8pt /10

One of Sony’s biggest successes came through courting adult gamers. Rather than positioning the PlayStation as a kids’ toy, they marketed it as sophisticated, mature entertainment. Games like *Ridge Racer* (1995), *Resident Evil* (1996), *Final Fantasy VII* (1997), and *Metal Gear Solid* (1998) represented a seismic shift in gaming’s cultural importance — from children’s pastimes to serious, mature narratives and experiences that resonated with adult audiences. This wasn’t just about blood and gore. It was about complex storytelling, emotional depth, and themes that respected players’ intelligence.

6pt /8

While Sony embraced CD-ROMs, Nintendo remained firmly attached to cartridge technology. Their reasoning was grounded in both technical and philosophical concerns: cartridges offered instant loading times, superior durability, and an added layer of piracy resistance that CDs couldn’t provide. For Nintendo, gameplay quality was paramount. However, this decision came with significant drawbacks. Limited storage capacity meant the N64 couldn’t compete with PlayStation in terms of multimedia features like full-motion video or extensive voice acting. Manufacturing costs were astronomical. This led to the eventual exodus of many third-party developers to Sony’s platform. Yet Nintendo’s innovation didn’t stop at the games. The N64 controller introduced groundbreaking features that changed how we played forever: the analog stick allowed for 360-degree movement in 3D space, the Rumble Pak brought force feedback to consoles, and the expansion slot opened doors for future peripherals.

90pt

World Wide

40pt /44

The World Wide Web known as WWW, W3.

30pt /33

The Web was invented by English computer scientist Tim Berners-Lee while at CERN in 1989.

22pt /25

It was conceived as a “universal linked information system”. Documents and other media content are made available to the network through web servers.

18pt /21

Servers and resources on the World Wide Web are identified and located through a character string called uniform resource locator. The original and still very common document type is a web page formatted in Hypertext Markup Language (HTML).

16pt /20

This markup language supports plain text, images, embedded video and audio contents, and scripts (short programs) that implement complex user interaction. The HTML language also supports hyperlinks (embedded URLs), which provide immediate access to other web resources. Web navigation, or web surfing, is the common practice of following such hyperlinks across multiple websites. Web applications are web pages that function as application software. The information on the Web is transferred across the Internet using HTTP.

14pt /18

A single web server may provide multiple websites, while some websites, especially the most popular ones, may be provided by multiple servers. Website content is provided by a myriad of companies, organisations, government agencies, and individual users; and comprises an enormous amount of educational, entertainment, commercial, and government information. The World Wide Web has become the world's dominant information systems platform.

11pt /14

Tim Berners-Lee states that *World Wide Web* is officially spelled as three separate words, each capitalised, with no intervening hyphens. The *www* prefix has been declining, especially when web applications sought to brand their domain names and make them easily pronounceable

10pt /12

The terms Internet and *World Wide Web* are often used without much distinction. However, the two terms do not mean the same thing. The Internet is a global system of computer networks interconnected through telecommunications and optical networking. In contrast, the *World Wide Web* is a global collection of documents and other resources,

8pt /10

Viewing a web page on the World Wide Web normally begins either by typing the URL of the page into a web browser or by following a hyperlink to that page or resource. The web browser then initiates a series of background communication messages to fetch and display the requested page. In the 1990s, using a browser to view web pages—and to move from one web page to another through hyperlinks—came to be known as 'browsing,' 'web surfing' (after channel surfing), or 'navigating the Web'. Early studies of this new behaviour investigated user patterns in using web browsers.

6pt /8

The following example demonstrates the functioning of a web browser when accessing a page at the URL http://example.org/home.html. The browser resolves the server name of the URL (example.org) into an Internet Protocol address using the globally distributed Domain Name System (DNS). This lookup returns an IP address such as *203.0.113.4 or 2001:db8:2e::7334*. The browser then requests the resource by sending an HTTP request across the Internet to the computer at that address. It requests service from a specific TCP port number that is well known for the HTTP service, so that the receiving host can distinguish an HTTP request from other network protocols it may be servicing. HTTP normally uses port number 80 and, for HTTPS, it normally uses port number 443. The content of the HTTP request can be as simple as two lines of text.

90pt

Discman

40pt /44

was a brand name used by Sony.

30pt /33

The first Discman, the Sony D-50 or D-5 (depending on region), was launched in 1984.

22pt /25

The Sony brand name for Discman changed to CD Walkman, initially for Japanese lineups launched between October 1997 and March 1998.

18pt /21

Discman and CD Walkman players were discontinued at the beginning of the 2010s, when they lost popularity with the general public, CD Walkman.

16pt /20

Prior to the development of the Compact disc, cassette tapes were the dominant form of audio storage in the then-fledgling portable audio industry. In 1979, Sony introduced the Walkman in Japan. When Sony realized the potential of the CD, the Walkman was promoted to mainstream buyers. Sony improved the design of the CDP-101 CD player which was launched in 1982, reducing the power consumption and the number of parts needed and making it smaller. The cost was reduced.

14pt /18

The final design did not incorporate a power source and had a 9-volt (positive outer) coaxial jack on the rear. This allowed the use of an EBP-9LC wall adapter, a carrying sleeve which held six primary C cells, or rechargeable cells which could be charged in situ. The AC-D50 AC adapter was also available, which attached to the rear of the D-50/D-5 and allowed it to be powered from AC input.

11pt /14

The D-50/D-5 was launched in November 1984, two years after mass production of CDs began. The unit offered the same functions as the full-size CDP-101 player, but came without a remote control and the repeat function of the full-size.

10pt /12

The D-50/D-5 retailed for 49,800 yen (US$350 in 1984), approximately half the price of the CDP-101. The D-50/D-5 sparked public interest in CDs, boosting their popularity, and within a year and a half had become profitable. Early production units of the D-50/D-5 did not carry the Discman brand.

8pt /10

The Discman brand was applied later because of the unit's portability and similarity to the cassette Walkman. This brand name was used for Sony's portable CD players until 2000. The release of the D-50/D-5 sparked public interest in CDs as an audio format, and in the audio industry in general. A portable CD market was created and the price of competing CD players from other manufacturers dropped. The CD industry experienced sudden growth, with the number of CD titles available dramatically increasing.

6pt /8

The ATRAC CD Walkman played ATRAC CDs in addition to audio CDs. The ATRAC CD contained audio encoded in ATRAC3 or ATRAC3plus. Most, if not all, models also played MP3s. The D-NE1 from 2003 was one of the earliest models. Video CD Discman, later rebranded as VCD Walkman, was a line of portable Video CD players. They were able to output the audio from video CDs as usual, but were also equipped with an additional 3.5mm audio/video-to-RCA connector output.

- Intelligent Discman was a line of Discman players that played CD-i format discs.
- CD-ROM Discman, both Sony and Panasonic released portable CD players with a PCMCIA card connector for use as an external CD-ROM drive on a computer, though with a lower speed than dedicated computer drives.

90pt

☑ Circled numbers

MP③

40pt /44

Formally MPEG-1 Audio Layer III

30pt /33

is an audio coding format developed largely by the Fraunhofer Society in Germany [Karlheinz]

22pt /25

It was designed to greatly reduce the amount of data required to represent audio, yet still sound like a faithful reproduction.

18pt /21

For example, compared to CD-quality digital audio, MP3 compression can commonly achieve a 75–95% reduction in size, depending on the bit rate $$$.

16pt /20

MPEG-1 Audio Layer III was originally defined in 1991 as one of the three possible audio codecs of the MPEG-1 standard (along with MPEG-1 Audio Layer I and MPEG-1 Audio Layer II). All three options were retained and further extended—defining additional bit rates and support for more audio channels (supporting surround sound—in the subsequent MPEG-2 standard). MP3 as a file format commonly designates files containing an elementary stream of MPEG-1 Audio.

14pt /18

Concerning audio compression, which is its most apparent element to end-users, MP3 uses lossy compression to reduce precision of encoded data and to partially discard data, allowing for a large reduction in file sizes when compared to uncompressed audio. The combination of small size and acceptable fidelity led to a boom in the distribution of music over the Internet in 1990's.

11pt /14

The Moving Picture Experts Group (MPEG) designed MP3 as part of its MPEG-1, and later MPEG-2, standards. MPEG-1 Audio (MPEG-1 Part 3), which included MPEG-1 Audio Layer I, II, and III, was approved as a committee draft for an ISO/

10pt /12

The MP3 lossy compression algorithm takes advantage of a perceptual limitation of human hearing called auditory masking. In 1894, the American physicist Alfred M. Mayer reported that a tone could be rendered inaudible by another tone of lower frequency [Bell Labs].

8pt /10

The MP3 lossy compression algorithm takes advantage of a perceptual limitation of human hearing called auditory masking. In 1894, the American physicist Alfred M. Mayer reported that a tone could be rendered inaudible by another tone of lower frequency. In 1959, Richard Ehmer described a complete set of auditory curves regarding this phenomenon. Between 1967 and 1974, Eberhard Zwicker did work in the areas of tuning and masking of critical frequency-bands.

6pt /8

Perceptual coding was first used for speech coding compression with linear predictive coding (LPC), which has origins in the work of Fumitada Itakura (Nagoya University) and Shuzo Saito (Nippon Telegraph and Telephone) in 1966. In 1978, Bishnu S. Atal and Manfred R. Schroeder at Bell Labs proposed an LPC speech codec, called adaptive predictive coding, that used a psychoacoustic coding-algorithm exploiting the masking properties of the human ear. Further optimization by Schroeder and Atal with J.L. Hall was later reported in a 1979 paper. That same year, a psychoacoustic masking codec was also proposed by M. A. Krasner, who published and produced hardware for speech (not usable as music bit-compression), but the publication of his results in a relatively obscure Lincoln Laboratory Technical Report did not immediately influence the mainstream of psychoacoustic.

90pt

VHS Tape

40pt /44

The Golden Era of VHS in the 1990s

30pt /33

The 1990s represented the final golden decade of the VHS era.

22pt /25

A time when the familiar rectangular cassette dominated living rooms across the world.

18pt /21

Originally developed by JVC in the 1970s, the VHS (Video Home System) format became the standard for home video throughout the 80s and especially the 90s.

16pt /20

For many families, Friday nights meant a trip to the local video rental store. Chains like Blockbuster became cultural icons, with their bright blue-and-yellow branding and endless shelves of plastic cases. Walking through the aisles was an experience in itself: customers would browse horror, comedy, action, and family sections, hoping their desired film wasn't already rented out. New releases were displayed prominently.

14pt /18

The 90s also marked a major expansion in home entertainment. Popular films such as Jurassic Park, Titanic, and The Lion King sold millions of VHS copies worldwide. In fact, some releases were so successful that they broke sales records for home media at the time. Disney, in particular, turned its animated classics into anticipated VHS events.

11pt /14

Owning a VHS collection became a point of pride. Families would store tapes in wooden cabinets or stack them beside the television. Recording television shows was another popular use. With a programmable VCR.

10pt /12

However, VHS technology had limitations. Tapes would wear out, rewind times could be frustrating, and video quality would degrade after repeated viewings. Despite these flaws, VHS had something modern digital media often lacks: tangibility. The act of inserting

8pt /10

Hearing the mechanical whirring of the VCR, and rewinding tapes before returning them created rituals that defined the decade.
By the late 1990s, a new format was emerging. DVDs offered clearer picture quality, interactive menus, and no need for rewinding. Gradually, DVD players replaced VCRs, and the VHS era came to an end in the early 2000s. Yet for many, the 1990s remain the nostalgic peak of VHS culture–a time when movie nights felt like events and physical

6pt /8

By the late 1990s, a new format was emerging. DVDs offered clearer picture quality, interactive menus, and no need for rewinding. Gradually, DVD players replaced VCRs, and the VHS era came to an end in the early 2000s. Yet for many, the 1990s remain the nostalgic peak of VHS culture–a time when movie nights felt like events and physical media ruled the entertainment world. As with almost all cassette-based videotape systems, VHS machines pull the tape out of the cassette shell and wrap it around the inclined head drum, which rotates at 1,800 rpm in NTSC machines and at 1,500 rpm for PAL, one complete rotation of the head corresponding to one video frame. VHS uses an "M-loading" system, also known as M-lacing, where the tape is drawn out by two threading posts and wrapped.

90pt

Daydreams

40pt /44

VHS Memories in the 1990s

30pt /33

VHS tapes were more than just a way to watch movies they were a defining part of childhood

22pt /25

Before streaming platforms and digital downloads, children grew up rewinding their favorite films over and over again.

18pt /21

Animated classics, action movies, and sitcom recordings filled living rooms with flickering analog images. Companies such as Disney and Warner Bros. dominated the children’s market.

16pt /20

Brightly colored VHS cases—especially the iconic “Disney clamshell” boxes—became instantly recognizable. Movies like Aladdin, Home Alone, and Toy Story were replayed so often that some tapes eventually wore out. The social aspect of VHS culture was equally important. Sleepovers often revolved around choosing a movie to watch, negotiating with friends over horror versus comedy. Recording content from television was common practice;

14pt /18

many households had unlabelled tapes containing a mix of cartoons, commercials, and special events. These homemade recordings now serve as accidental time capsules of 1990s pop culture. Video rental stores were community hubs. Independent shops competed with major chains, offering loyalty cards and special deals.

11pt /14

Late fees became both feared and inevitable, adding a small sense of urgency to the rental experience. The process of rewinding a tape before returning it was considered polite—and some stores even charged.

10pt /12

Technologically, VHS represented analog media at its peak. Unlike today’s instant streaming, watching a film required patience. There were no chapter selections; fast-forwarding meant guessing where a scene might begin. Yet this limitation created a deeper

8pt /10

Viewers memorized dialogue, specific tape distortions, and even the order of previews before the main feature. As the 2000s approached, DVDs gradually replaced VHS, offering better sound and image quality. By the mid-2000s, VHS production had nearly disappeared. Still, the 1990s VHS era remains a powerful symbol of a transitional time—when technology was advancing rapidly but still required physical interaction. The act of inserting a cassette.

6pt /8

Today, collectors and nostalgia enthusiasts seek original 90s VHS tapes, appreciating their cover art and retro aesthetic. For those who grew up in that decade, the soft static at the beginning of a tape and the phrase “Be Kind, Rewind” evoke a simpler era of home entertainment—one defined by anticipation, community, and the unmistakable charm of VHS. By the late 1990s, a new format was emerging. DVDs offered clearer picture quality, interactive menus, and no need for rewinding. Gradually, DVD players replaced VCRs, and the VHS era came to an end in the early 2000s. Yet for many, the 1990s remain the nostalgic peak of VHS culture—a time when movie nights felt like events and physical media ruled the entertainment world.

714pt

Glyph Overview Display

Uppercase

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Lowercase

a b c d e f g h i j k l m n o p q r s t u v w x y z

Diacritics Uppercase

Á À Â Ã Ä Å Ā Ă Ą Ạ Ả Ắ Ặ Ằ Ẳ Ẵ Ấ Ậ Ầ Ẫ Æ Ǽ Ç Ć Ĉ Ċ Č Ď Đ
Ð É È Ê Ë Ē Ĕ Ė Ẹ Ẻ Ẽ Ę Ě Ế Ệ Ề Ể Ễ Ĝ Ğ Ġ Ģ Ĥ Ħ Í Ì Î Ï Ĩ Ī Ĭ Į Ị Ỉ Ĩ Ɨ Ĳ
Ĵ Ķ Ķ Ĺ Ľ Ļ Ŀ Ł Ń Ǹ Ņ Ň Ñ Ŋ Ó Ò Ô Ǒ Õ Ō Ö Ǒ Ȯ Ő Ố Ộ Ồ Ổ
Ỗ Ọ Ỏ Ơ Ớ Ợ Ờ Ở Ỡ Ǫ Ø Ǿ Œ Þ Ŕ Ŗ Ř Ś Ŝ Š Ş Ș ẞ Ţ Ŧ Ť Ț Ú Ŭ Ǔ
Û Ũ Ü Ǘ Ǔ̈ Ǜ Ǖ Ụ Ù Ủ Ư Ứ Ự Ừ Ử Ữ Ű Ū Ų Ů Ʉ Ẃ Ẁ Ẅ Ŵ Ẋ Ý Ŷ Ÿ
Ỵ Ỳ Ỷ Ȳ Ỹ Ź Ż Ž Ƶ

Diacritics Lowercase

á à â ã ă å ā ă ą ạ ả ắ ặ ằ ẳ ẵ ấ ậ ầ ẩ ẫ æ ǽ ç ć ĉ ċ č ď đ ð é è ê ë ē
ĕ ė ẹ ẻ ẽ ę ě ế ệ ề ể ễ ə ĝ ğ ǧ ġ ģ ĥ ħ í ì î ï ĩ ī ĭ į ị ỉ ɨ ĳ ĵ ǰ ķ ķ ĸ Ĺ ľ ļ ŀ
ł ń ǹ ņ ň ñ ŋ ŋ ó ò ô ǒ õ ō ö ǒ ȯ ő ố ộ ồ ổ ỗ ọ ỏ ơ ớ ợ ờ ở ỡ ǫ ø
ǿ œ þ ŕ ŗ ř ś ŝ š ş ș ß ţ ŧ ť ț ú ŭ ǔ û ũ ü ǘ ǔ̈ ǜ ǖ ụ ù ủ ư ứ ự ừ ử ữ ű
ū ų ů ʉ ẃ ẁ ẅ ŵ ẋ ý ŷ ÿ ỿ ỳ ỷ ȳ ỹ ź ż ž ƶ

Ordinals

a b c d e f g h i j k l m n o p q r s t u v w x y z

Proportional & Tabular Lining Figures

1234567890 1234567890

Proportional & Tabular Oldstyle Figures

1234567890 1234567890

Glyph Overview Display

Punctuation and Symbols

. , … : ; ¡ ! ? ¿ ‽ ⸘ ‼ ( ) [ ] { } ⟨ ⟩ / | ‖ ¦ \ ′ ″ ‴ " ' ' ' ‚ " " „ ‹ › « » - ‒ – — ― _ ‗ • ˜ ˆ † ‡ & № # ¶ § @ © ® ℗ ™ ℠ º * ⁑ ⁂ ℓ ℮

White Incised Figures

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

Roman Numbers

Ⅰ Ⅱ Ⅲ Ⅳ Ⅳ Ⅴ Ⅵ Ⅶ Ⅷ Ⅸ Ⅹ Ⅼ Ⅽ Ⅾ Ⅿ

Numerators & Denominators

( ) + - = 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 + - = ( )

Superiors & Inferiors

( ) + - = 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 + - = ( )

Pre-Built Fractions

½ ⅓ ⅔ ¼ ¾ ⅕ ⅖ ⅗ ⅘ ⅙ ⅚ ⅛ ⅜ ⅝ ⅞ 1⁄16 3⁄16 5⁄16 7⁄16 9⁄16 11⁄16 13⁄16 15⁄16

Math Symbols

+ − × ÷ = ≈ ≠ ± ≡ ¬ < > ≤ ≥ π µ ∂ ◊ ∆ ∏ ∑ √ ∫ ∞ # % ‰

Currency Symbols

¤ ¢ ฿ ₲ ₵ € ¥ ₦ ₱ ₴ £ ₩ ₹ ₮ ₺ ₡ ₵ ₿ ₤ ₾ ₧ ₽ ₹ ₣ ƒ ₭ ₼ ₢ ₨ ₪ ₫ ₸

Tabular Math & Currency Symbols

+ − × ÷ = ≈ ≠ ± < > ≤ ≥ # % ‰

¤ ¢ ฿ ₲ ₵ € ¥ ₦ ₱ ₴ £ ₩ ₹ ₮ ₺ ₡ ₵ ₿ ₤ ₾ ₨ ₽ ₹ ₣ ƒ ₭ ₼ ₢ ₨ ₪ ₫ ₸

Icons

■ □ ⊠ ■ □ ⊠ ☑ ● ○ ◉ ● ○ ⌂ ✓ ✕ ♻ ♻ ♻ ♳ ♴ ♵ ♶ ♷ ♸ ♹ ♺

▼ ◥ ◀ ◢ ▲ ◣ ▶ ◤ ✷ ☼ ☾ ♠ ♣ ♥ ♦ ⚠

Arrows

← → ↑ ↓ ↖ ↗ ↘ ↙ ↔ ↕ ↩ ↪ ↯ ↰ ↱ ↵ ↳ ⇆ ☈ ← ↑ → ↓

Glyph Overview Text

Uppercase

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Lowercase

a b c d e f g h i j k l m n o p q r s t u v w x y z

Diacritics Uppercase

Á À Â Ã Ä Å Ā Ă Ą Ạ Ả Ắ Ặ Ằ Ẳ Ẵ Ấ Ậ Ầ Ẫ Æ Ǽ Ç Ć Ĉ Ċ Č Ď Đ
Ð É È Ê Ë Ē Ĕ Ė Ę Ẹ Ẻ Ẽ Ę Ě Ế Ệ Ề Ể Ễ Ĝ Ğ Ǧ Ġ Ģ Ĥ Ħ Í Ì Î Ǐ Ï Ĩ Ī Ĭ Į Ị İ
Ỉ Ɨ IJ Ĳ Ĵ Ǩ Ķ Ĺ Ľ Ļ Ŀ Ł Ł Ń Ǹ Ņ Ň Ñ Ŋ Ŋ Ó Ò Ô Ǒ Õ Ō Ö Ǒ Ȯ Ő Ố
Ộ Ồ Ổ Ỗ Ọ Ỏ Ơ Ớ Ợ Ờ Ở Ỡ Ǫ Ø Ǿ Œ Þ Ŕ Ŗ Ř Ś Ŝ Š Ş Ș ẞ Ţ Ŧ
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Diacritics Lowercase

á à â ã ă å ā ă ą ạ ả ắ ặ ằ ẳ ẵ ấ ậ ầ ẩ ẫ æ ǽ ç ć ĉ ċ č ď đ ð é è
ê ë ē ĕ ė ę ẻ ẽ ę ě ế ệ ề ể ễ ə ĝ ğ ǧ ġ ģ Ĥ ħ í ì î ǐ ï ĩ ī ĭ į ị ı ỉ ɨ ij ĳ ĵ
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ụ ù ủ ư ứ ự ừ ử ữ ű ū ų ů ᵾ ẃ ẁ ẅ ŵ ẋ ý ŷ ÿ ỿ ỳ ỷ ȳ ỹ ź ż ž ƶ

Ordinals

a b c d e f g h i j k l m n o p q r s t u v w x y z

Proportional & Tabular Lining Figures

1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0

Proportional & Tabular Oldstyle Figures

1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0

Glyph Overview Text

Punctuation and Symbols

. , … : ; ¡ ! ? ¿ ʔ ¿ ‼ ( ) [ ] { } ⟨ ⟩ / | ‖ ¦ \ ′ ″ ‴ ‶ ′ ‘ ’ , “ ” „ ‹ › « » – — ― ‒ _ ⁼ • ˜ ^ † ‡ & № # ¶ § @ © ® ℗ ™ ℠ ° * ⁎ ⁂ ℓ ℮

White Incised Figures

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

Roman Numbers

Ⅰ Ⅱ Ⅲ Ⅳ Ⅳ Ⅴ Ⅵ Ⅶ Ⅷ Ⅸ Ⅹ Ⅼ Ⅽ Ⅾ Ⅿ

Numerators & Denominators

( ) + − = 1 2 3 4 5 6 7 8 9 0 ₁ ₂ ₃ ₄ ₅ ₆ ₇ ₈ ₉ ₀ ₊ ₋ ₌ ₍ ₎

Superiors & Inferiors

( ) + − = 1 2 3 4 5 6 7 8 9 0 ₁ ₂ ₃ ₄ ₅ ₆ ₇ ₈ ₉ ₀ ₊ ₋ ₌ ₍ ₎

Pre-Built Fractions

½ ⅓ ⅔ ¼ ¾ ⅕ ⅖ ⅗ ⅘ ⅙ ⅚ ⅛ ⅜ ⅝ ⅞ 1⁄16 3⁄16 5⁄16 7⁄16 9⁄16 11⁄16 13⁄16 15⁄16

Math Symbols

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Currency Symbols

¤ ¢ ฿ ₲ ₡ € ¥ ₦ ₱ ₴ £ ₩ ₹ ₮ ₺ ₭ ₾ ₿ £ ৳ Pts ₽ ₹ �£ ƒ ₭ ₼ ₲ Rs ₪ ₫ ₸

Tabular Math & Currency Symbols

+ − × ÷ = ≈ ≠ ± < > ≤ ≥ # % ‰

¤ ¢ ฿ ₲ ₡ € ¥ ₦ ₱ ₴ £ ₩ ₹ ₮ ₺ ₭ ₾ ₿ £ ৳ ₨ ₽ ₹ ₣ ƒ ₭ ₼ ₲ ₨ ₪ ₫ ₸

Icons

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Arrows

Glyph Overview Semi Mono Text

Uppercase

ABCDEFGHIJKLMNOPQRSTUVWXYZ

Lowercase

abcdefghijklmnopqrstuvwxyz

Diacritics Uppercase

ÁÀÂÃÄÅĀĂĄẠẢẮẶẰẲẴẤẬẦẨÃÆÆÇĆĈĊČĎĐĐÉÈÊËĒ
ĔĖĘẺẼĘĚẾỆỀỂỄĜĞĞĠĢĤĦÍÌÎĬÏĨĪĬĮỊỈỉĦIJÍJĴĶĶĹĽĻ
Ŀ·ŁŁŃŃŅŇÑŊŊÓÒÔŎÕŌÖŎȮŐỐỘỒỔỖỌỎƠỚỢỜỞỠǪØ
ØŒÞŔŖŘŚŜŠŞṢßŢŦŤṬÚŬŬÛŨŪÜŰŮỤÙỦƯỨỰỪỬỮŰŪ
ǪŮŦẂẀẄŴẊÝŶŸỴỲỶỸŸŹŻŽƵ

Diacritics Lowercase

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øœþŕŗřśŝšşṣßţŧťṭúŭŭûũüűǔůūụùủưứựừửữűū-
ǫůŧẃẁẅŵẋýŷÿỵỳỷỹÿźżžƶ

Ordinals

abcdefghijklmnopqrstuvwxyz

Proportional & Tabular Lining Figures

1234567890 1234567890

Proportional & Tabular Oldstyle Figures

1234567890 1234567890

Glyph Overview Semi Mono Text

Punctuation and Symbols

. , … : ; ¡ ! ? ¿ ʔ ¿ ‼ ( ) [ ] { } ⟨ ⟩
/ | ‖ ¦ \ ′ ″ ‴ ‶ ′ ‘ ’ , “ ” „ ‹ › « » – — – —
− _ = • ˜ ^ † ‡ & № # ¶ § @ © ® ℗ ™ ℠ ° * ⁎ ⁂ ℓ ℮

White Incised Figures

⓵⓶⓷⓸⓹⓺⓻⓼⓽

Roman Numbers

Ⅰ Ⅱ Ⅲ Ⅳ Ⅳ Ⅴ Ⅵ Ⅶ Ⅷ Ⅸ Ⅹ L C D M

Numerators & Denominators

( ) + − = 1 2 3 4 5 6 7 8 9 0 ₁ ₂ ₃ ₄ ₅ ₆ ₇ ₈ ₉ ₀ + − = ( )

Superiors & Inferiors

( ) ⁺ ⁻ ⁼ 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 + − = ( )

Pre-Built Fractions

1⁄2 1⁄3 2⁄3 1⁄4 3⁄4 1⁄5 2⁄5 3⁄5 4⁄5 1⁄6 5⁄6 1⁄8 3⁄8 5⁄8 7⁄8 1⁄16 3⁄16 5⁄16 7⁄16 9⁄16 11⁄16 13⁄16 15⁄16

Math Symbols

+ − × ÷ = ≈ ≠ ± ≡ ¬ < > ≤ ≥ π µ ∂ ◊ Δ Π Σ √ ∫ ∞ # % ‰

Currency Symbols

¤ ¢ ฿ ₲ ₡ € ¥ ₦ ₱ ₴ £ ₩ ₹ ₮ ₺ ₭ ₾ ₿ £ ৳ ₨ ₽ ₹ ₣ ƒ ₭ ₼ ₲ Rs ₪ ₫ ₸

Icons

■ □ ☒ ■ □ ☒ ☑ ● ○ ◎ ● ○ ☗ ✓ ✕ ♻ ✪ ❂ ♻ ⓵ ⓶ ⓷ ⓸ ⓹ ⓺ ⓻ ⓽ ▼ ◤ ◀ ◢ ▲ ◣ ▶ ◥ ▼
✷ ✵ ☾ ♠ ♣ ♥ ♦ ⚠

Arrows

← → ↑ ↓ ↖ ↗ ↘ ↙ ↔ ↕ ↩ ↪ ↯ ↰ ↱ ↵ ↳ ⇆ ⇄ ← ↑ → ↓

Glyph Overview Mono Text

Uppercase

ABCDEFGHIJKLMNOPQRSTUVWXYZ

Lowercase

abcdefghijklmnopqrstuvwxyz

Diacritics Uppercase

ÁÀÂÃÄÅĀĂĄẠẢẮẶẰẲẴẤẬẦẪÆǼÇĆĈĊČĎĐÐÉÈÊËĒĔĖ
ẸẺẼĘĚẾỆỀỂỄĜĞǦĠĢĤĦÍÌÎǏÏĨĪĬĮỊİỈƗĲĲ́ĴǨĶĹĽ
ĻĿŁȽŃǸŅŇÑƝŊÓÒÔǑÕŌÖŎȮŐỐỘỒỔỖỌỎƠỚỢỜỞỠǪØǾ
ŒÞŔŖŘŚŜŠŞȘẞŢŦŤȚÚŬǓÛŨÜǗǙǛǕỤÙỦƯỨỰỪỬỮŰŪŲŮ-
ɄẂẀẄŴẊÝŶŸỴỲỶȲỸŹŻŽƵ

Diacritics Lowercase

áàâãǎåāăąạảắặằẳẵấậầẩẫæǽçćĉċčďđðéèêëēĕė
ẹẻẽęěếệềểễəĝğǧġģĥħíìîǐïĩīĭįịıỉɨĳĳ́ĵǩķĸ
ĺľļŀłƚńǹņňñɲŋóòôǒõōöŏȯőốộồổỗọỏơớợờởỡǫ
øǿœþŕŗřśŝšşșßţŧťțúŭǔûũüǘǚǜǖụùủưứựừửữűū-
ųůʉẃẁẅŵẋýŷÿỵỳỷȳỹźżžƶ

Ordinals

a b c d e f g h i j k l m n o p q r s t u v w x y z

Proportional & Tabular Lining Figures

1234567890 1234567890

Proportional & Tabular Oldstyle Figures

1234567890 1234567890

Glyph Overview Mono Text

Punctuation and Symbols

. , … : ; ¡ ! ? ¿ ⁇ ¿ ‼ ( ) [ ] { } 〈 〉
/ | ‖ ¦ \ ′ ″ ‴ ‟ ′ ‘ ’ , “ ” „ ‹ › « » – — – –
– _ = • ~ ^ † ‡ & № # ¶ § @ © ® ℗ ™ ℠ ° * ⁑ ⁂ ℓ ℮

White Incised Figures

⓵⓶⓷⓸⓹⓺⓻⓼⓽

Roman Numbers

Ⅰ Ⅱ Ⅲ Ⅳ Ⅴ Ⅵ Ⅶ Ⅷ Ⅸ Ⅹ L C D M

Numerators & Denominators

( ) + − = 1 2 3 4 5 6 7 8 9 0 ₁ ₂ ₃ ₄ ₅ ₆ ₇ ₈ ₉ ₀ + − = ( )

Superiors & Inferiors

( ) ⁺ ⁻ ⁼ 1234567890 ₊ ₋ ₌ ( )

Pre-Built Fractions

1⁄2 1⁄3 2⁄3 1⁄4 3⁄4 1⁄5 2⁄5 3⁄5 4⁄5 1⁄6 5⁄6 1⁄8 3⁄8 5⁄8 7⁄8 1⁄16 3⁄16 5⁄16 7⁄16 9⁄16 11⁄16 13⁄16 15⁄16

Math Symbols

+ − × ÷ = ≈ ≠ ± ≡ ¬ < > ≤ ≥ π µ ∂ ◊ Δ ∏ Σ √ ∫ ∞ # % ‰

Currency Symbols

¤ ¢ ฿ ₲ ₡ € ¥ ₦ ₱ ₴ £ ₩ ₹ ₮ ₺ ₭ ₼ ₾ ₿ £ ৳ ₨ ₽ ₹ ₣ ƒ ₭ ₥ ₲ ₨ ₪ ₫ ₸

Icons

■ □ ☒ ■ □ ☒ ☑ ● ❍ ◎ ● ❍ ☗ ✓ ✕ ✪ ❁ ✪ ➀ ➁ ➂ ➃ ➄ ➅ ➆ ➇ ▼ ◥ ◀ ◢ ▲ ◣ ▶ ◤ ✷ ✵ ☾ ♠ ♣ ♥ ♦ ⚠

Arrows

← → ↑ ↓ ↖ ↗ ↘ ↙ ↔ ↕ ↩ ↪ ↯ ↰ ↱ ↵ ↳ ⇆ ⇞ ← ↑ → ↓

Open Type Features

Case Specific Punctuation

(‖)/[\]{|}⟨¦⟩¡¿?
«•» ‹•› – – – — @ ® Ⓟ

→ (leyak) (LEYAK)

Superscript Ordinals

abcdefghijklmnopqrstuvwxyz

→ Jan 23rd

Automatic Fractions

1/3 → ⅓

→ 0123456789/0123456789

Superiors / Inferiors

+-=()0123456789

→ $10^{2} \times 9^{(3+5)}$

1234567890+-=()

→ $H_2O\ C_4H_{10}$

Proportional Lining & Oldstyle Figures

0123456789

→ 0123456789 $%

Tabular Lining & Oldstyle Figures

0123456789

→ 0123456789

Tabular Lining

#Ghost 5.50$ 23%
5500‰

→ #Ghost 5.50$ 23%
5500‰

Open Type Features

(Roman) Stylistic Set 01 - Alternate ‘a’

a → a Garayaka → Garayaka

(Italic) Stylistic Set 02 - Alternate ‘k’

k → k Kichkandi → Kichkandi

Stylistic Set 03 - Alternate ‘ij’

IJ → IJ IJDEL → IJDEL

Stylistic Set 04 - Alternate Arrows

↑ → ↑ ← → ↓ → ↞ ↠ ↡

Stylistic Set 05 - Alternate Boxes

■ → ■ ■ ☐ ☑ ☒ → ■ ☐ ☑ ☒

Stylistic Set 06 - Circled Numbers

1 → ① 23456789 → ②③④⑤⑥⑦⑧⑨

Stylistic Set 07 - Roman Numerals

1 → I 2, 3, 4, 5, 6, 7, 8, 9, 10, 50, 100, 500, 1000 → II III IV V VI VII VIII IX X L C D M

Ligatures

fi → fi Fifth difficulty → Fifth difficulty

ff fi fl ft ffi fft → ff fi fl ft ffi fft

Language support

- Abron
- Acheron
- Achinese
- Acholi
- Achuar-Shiwiar
- Adangme
- Afar
- Afrikaans
- Aguaruna
- Ahtna
- Akoose
- Alekano
- Aleut
- Algonquin
- Amahuaca
- Amarakaeri
- Amis
- Anaang
- Andaandi
- Anufo
- Anuta
- Ao Naga
- Apinayé
- Arabela
- Aragonese
- Arbëreshë Albanian
- Arvanitika Albanian
- Asháninka
- Ashéninka Perené
- Asu (Tanzania)
- Atayal
- Awa-Cuaiquer
- Awing
- Baatonum
- Bafia
- Balinese
- Bambara
- Banjar
- Baoulé
- Bari
- Basque
- Batak Dairi
- Batak Karo
- Batak Mandailing
- Batak Simalungun
- Batak Toba
- Bemba (Zambia)
- Bena (Tanzania)
- Biali
- Bikol
- Bini
- Bislama
- Boko (Benin)
- Bora
- Borana-Arsi-Guji Oromo
- Bosnian
- Breton
- Buginese
- Candoshi-Shapra
- Caquinte
- Caribbean Hindustani
- Cashibo-Cacataibo
- Cashinahua
- Catalan
- Cebuano
- Central Aymara
- Central Kurdish
- Central Nahuatl
- Cerma
- Chachi
- Chamorro
- Chavacano
- Chayahuita
- Chiga
- Chiltepec Chinantec
- Chokwe
- Chuukese
- Cimbrian
- Cofán
- Congo Swahili
- Cook Islands Māori
- Cornish
- Corsican
- Creek
- Crimean Tatar
- Croatian
- Czech
- Danish
- Dehu
- Dendi (Benin)
- Dimli
- Dutch
- Dyula
- Eastern Arrernte
- Eastern Maninkakan
- Eastern Oromo
- Efik
- Embu
- English
- Ese Ejja
- Esperanto
- Ewondo
- Fanti
- Faroese
- Fijian
- Filipino
- Finnish
- French
- Friulian
- Ga
- Gagauz
- Galician
- Ganda
- Garifuna
- Ga'anda
- German
- Gheg Albanian
- Gilbertese
- Gonja
- Gooniyandi
- Gourmanchéma
- Guadeloupean Creole French
- Gusii
- Gwich'in
- Haitian
- Hani
- Hiligaynon
- Ho-Chunk
- Hopi
- Huastec
- Hungarian
- Hän
- Ibibio
- Icelandic
- Ido
- Idoma
- Iloko
- Inari Sami
- Indonesian
- Interglossa
- Interlingua
- Interlingue
- Irish
- Istro Romanian
- Italian
- Ixcatlán Mazatec
- Jamaican Creole English
- Javanese
- Jenaama Bozo
- Jola-Fonyi
- K'iche'
- Kabuverdianu
- Kaingang
- Kala Lagaw Ya
- Kalaallisut
- Kalenjin
- Kamba (Kenya)
- Kaonde
- Kaqchikel
- Karelian
- Kashubian
- Kekchí
- Kenzi/Mattokki
- Khasi
- Kikuyu
- Kimbundu
- Kinyarwanda
- Kirmanjki
- Kituba (DRC)
- Klingon
- Kongo
- Konzo
- Koyra Chiini Songhay
- Koyraboro Senni Songhai
- Krio
- Kuanyama
- Kven Finnish
- Kölsch
- Ladin
- Ladino
- Langi
- Latgalian
- Ligurian
- Lingala
- Lithuanian
- Lojban
- Lombard
- Low German
- Lower Sorbian
- Lozi
- Luba-Katanga
- Luba-Lulua
- Lule Sami
- Luo (Kenya and Tanzania)
- Luxembourgish
- Macedo-Romanian
- Makhuwa
- Makhuwa-Meetto
- Makonde
- Makwe
- Malagasy
- Malaysian
- Maltese
- Mamara Senoufo
- Mandinka
- Mandjak
- Mankanya
- Manx
- Maore Comorian
- Maori
- Mapudungun
- Marshallese
- Masai
- Matsés
- Mauritian Creole
- Mende (Sierra Leone)
- Meriam Mir
- Meru
- Meta'
- Metlatónoc Mixtec
- Mi'kmaq
- Minangkabau
- Mirandese
- Moba
- Mohawk
- Montagnais
- Montenegrin
- Munsee
- Murrinh-Patha
- Murui Huitoto
- Muslim Tat
- Mwani
- Mískito
- Naga Pidgin
- Ndonga
- Neapolitan
- Ngazidja Comorian
- Niuean
- Nobiin
- Nomatsiguenga
- North Azerbaijani
- North Ndebele
- Northern Kissi
- Northern Kurdish
- Northern Qiandong Miao
- Northern Sami
- Northern Uzbek
- Northwestern Ojibwa
- Norwegian
- Novial
- Nyamwezi
- Nyanja
- Nyankole
- Nyemba
- Nzima
- Occitan
- Ojitlán Chinantec
- Omaha-Ponca
- Orma
- Oroqen
- Otuho
- Palauan
- Paluan
- Pampanga
- Papantla Totonac
- Papiamento
- Paraguayan Guaraní
- Pedi
- Picard
- Pichis Asheninka
- Piemontese
- Pijin
- Pintupi-Luritja
- Pipil
- Pite Sami
- Pohnpeian
- Polish
- Portuguese
- Potawatomi
- Purepecha
- Páez
- Quechua
- Romanian
- Romansh
- Rotokas
- Rundi
- Rwa
- Samburu
- Samoan
- Sango
- Sangu (Tanzania)
- Saramaccan
- Sardinian
- Scots
- Scottish Gaelic
- Sena
- Seri
- Seselwa Creole French
- Shambala
- Sharanahua
- Shawnee
- Shilluk
- Shipibo-Conibo
- Shona
- Shuar
- Sicilian
- Silesian
- Slovak
- Slovenian
- Soga
- Somali
- Soninke
- South Azerbaijani
- South Ndebele
- Southern Aymara
- Southern Bobo Madaré
- Southern Dagaare
- Southern Qiandong Miao
- Southern Sami
- Southern Sotho
- Spanish
- Sranan Tongo
- Standard Estonian
- Standard Latvian
- Standard Malay
- Sundanese
- Susu
- Swahili
- Swati
- Swedish
- Swiss German
- Syenara Senoufo
- Tagalog
- Tahitian
- Taita
- Talysh
- Tasawaq
- Tedim Chin
- Tetum
- Tetun Dili
- Timne
- Tiv
- Tiéyaxo Bozo
- Toba
- Tok Pisin
- Tokelau
- Toki Pona
- Tonga (Tonga Islands)
- Tonga (Zambia)
- Tosk Albanian
- Tsakhur
- Tsonga
- Tswana
- Tumbuka
- Turkish
- Turkmen
- Tuvalu
- Twi
- Tzeltal
- Tzotzil
- Uab Meto
- Umbundu
- Ume Sami
- Upper Guinea Crioulo
- Upper Sorbian
- Urarina
- Venetian
- Veps
- Volapük
- Võro
- Waama
- Walloon
- Walser
- Wamey
- Wangaaybuwan-Ngiyambaa
- Waorani
- Waray (Philippines)
- Warlpiri
- Wasa
- Wayuu
- Welsh
- West Central Oromo
- West-Central Limba
- Western Abnaki
- Western Frisian
- Wik-Mungkan
- Wiradjuri
- Wolof
- Xavánte
- Xhosa
- Yagua
- Yanesha'
- Yangben
- Yanomamö
- Yao
- Yapese
- Yindjibarndi
- Yucateco
- Zarma
- Zulu
- Zuni
- Záparo

Formats:

Destktop: OTF, TTF, VF
Web: WOFF, WOFF2, VF
App: OTF, VF

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