THE FREE FONT MOVEMENT

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Dedicated to +Fravia

In the study of ideas, it is necessary to remember
that insistence on hard-headed clarity issues
from sentimental feeling, as it were a mist,
cloaking the perplexities of fact. Insistence on
clarity at all costs is based on sheer superstition
as to the mode in which human intelligence functions.
Our reasonings grasp at straws for premises
and float on gossamers for deductions.

— A. N. Whitehead, "Adventures in Ideas." (McLuhan, 1967)

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ABSTRACT

This dissertation examines the emerging free font movement, a small part of the larger free software and free culture movements.

Part A provides an overview of key concepts in the free software and culture movements. It starts by describing the hacker culture of the 1970s, the origins of Richard Stallman's GNU project, and his ethical basis for free software. Business and copyright practices are examined, and the cultural values of projects are described.

This is followed by an account of Stallman's theory of culture, and the Wikipedia and Creative Commons projects that are associated with this theory. Debates within the movement are explored, such as how Wikipedia develops, the role of non-commercial licensings, and the definition of 'free culture.'

Part B explores the implications of the principles of free culture for typeface design, attempting to answer whether typeface designs and fonts ought to be free. To do this it examines what typefaces are, who the users of typefaces are, and how type connects to Stallman's theory of culture.

It then discusses the relation of typefaces to font software, the different forms of digital type, and how font software connects to Stallman's theory. The legal status of typefaces and fonts is also considered.

Part C looks at what it means for fonts to be free, such as what font source code is. It examines how fonts are made free. The effects of various licensing practices and the ways font freedom is exercised are explored, such as collaborative community development processes.

A business model for sustainable commercial typeface design within the free culture movement is suggested, and a motivation for non-commercial typeface design activity is posed. Finally, areas for further research are suggested.

CONTENTS

1 INTRODUCTION

This dissertation examines the emerging free font movement. It starts by providing an overview of key concepts in the wider free software and free culture movements, by examining key figures and moments and explaining their motivations and significance. Having established the premises of the movement, it goes on to examine the implications of this to typeface design and font software. Finally, it discusses how the free font movement is practiced and areas of future development.

There are two chief intended audiences: type designers, and free culture advocates. Type design, like many other professions, has involved working intimately with computers for many years. Such professionals are often aware of the most publicised aspects of the free software and free culture movements—phrases such as 'open source,' popular applications like Mozilla Firefox, and the Wikipedia website. But they are less often familiar with its origins, goals and methods. It is hoped that a clear explanation of the movement will be of interest to type design professionals.

Free software and free culture advocates may also be interested in this author's account of the history of the movements, and the suggestions for progressing the movement in this crucial but obscure area of culture.

Part A

THE FREE CULTURE MOVEMENT

2 THE HACKER CULTURE

2.1 HACKERS, HEROES OF THE COMPUTER REVOLUTION

The free culture movement aims to reinforce a free society in the age of computer networks. It is intimately connected to the technology of the Internet that originated in the 'hacker' culture that formed around computers in the 1970s. Although today the term hacker is popularly understood as slang for computer criminals, it was initially a term of respect for computer programmers (Levy, 1984, p.432).

Levy's *"Hackers: Heroes of the computer revolution"* (1984) documents the origins of this culture in two groups. The earlier group formed around access to networked mainframe computers in science institutions such as at the Massachusetts Institute of Technology's Artificial Intelligence Laboratory (AI Lab). The later group was based around the earliest microcomputers that were used for computers games or simple data processing, and were not networked.

Levy codified an overall set of the culture's values that he labelled the 'hacker ethic':

> - Access to computers—and anything which might teach you something about the way the world works—should be unlimited and total.
> - All information should be free.[1]
> - Mistrust authority—promote decentralization.
> - Hackers should be judged by their hacking, not bogus criteria such as degrees, age, race, or position.
> - You can create art and beauty on a computer.
> - Computers can change your life for the better.
>
> (Levy, 1984, p.26–36)

The mainframe hackers' access to very expensive computers meant they were able to personally and directly advance the state of the art in software. But access was time-constrained and therefore they prized a flat distribution of power over the 'time-sharing' computers they worked with.

Lessig (2004, p.279) suggests that their "unlimited and total" access to software was a contextual characteristic of the computing industry at the time: Programs written for Data General machines would not work on IBM machines, so they were not motivated to exert any control. This context changed as the physical size and monetary cost of powerful computers fell, commoditising them, and their computational power rose geometrically.

1 The ambiguity in the word free is discussed in later sections.

Software developers became distinct from hardware developers, and many programmers left academia to start businesses. The most famous example of this trend today is Bill Gates, who dropped out of Harvard to found Microsoft in 1975, betting on the microcomputer trend (Wallace and Erickson, 1992). He went on to become the richest man in the world and his business model was simple: Each user must pay for permission to use each program on their computer.

This is achieved with 'End User licence Agreement' (EULA) contracts that require an agreement not to share, and with copyright law which also prohibits their unauthorised redistribution. His potential customers disagreed about this and actively redistributed the first Microsoft program, Altair BASIC.

Gates gained notoriety in the microcomputer hacker community when he responded by circulating a letter to popular computing journals throughout 1976, "An Open Letter to Hobbyists." He challenged software sharing as unfair and stated it was hobbling progress:

> Hardware must be paid for, but software is something to share. Who cares if the people who worked on it get paid? Is this fair? ... [You] prevent good software from being written. Who can afford to do professional work for nothing? What hobbyist can put 3-man years into programming, finding all bugs, documenting his product and distribute for free? ... Most directly, the thing you do is theft. (Levy, 1984, p.229)

2.2 DONALD KNUTH, AN EXEMPLARY HACKER

But the mainframe hackers viewed software as not as a product but as a service; being employed by institutions, they frequently did put years into writing, debugging, documenting and distributing a program without prohibiting sharing in order to charge per-user fees.

An example of this is Stanford mathematics professor, Donald Knuth. From 1968 he became famous, as computer scientists go, with his best-selling multi-volume textbook *"The Art of Computer Programming."* During the preparation of the third volume, he became frustrated with the poor quality of the phototypesetting technology that by 1977 had replaced the Monotype line caster metal typesetting technology used for his earlier volumes.

Digital typesetting systems were new in 1976, but Knuth realised that he himself could develop one in order to achieve the quality[2] he desired (Knuth, 1999, p.7). Writing such a large and sophisticated program took years of somewhat solitary work, but eventually Knuth successfully developed the 'TEX' typesetting system.[3] During its development he encountered the nascent culture of developer control,

2 "I had spent 15 years writing those books, but if they were going to look awful I didn't want to write any more." (Knuth, 1999, p.5)

3 TEX is used to typeset this dissertation. The system comprises several different components, including a programming language (`tex`), a program which interprets programs written in that language (TEX), and a format for representing pages in a device independent format which the TEXprogram outputs (DVI).

and rejected it: "A mathematical formula should never be 'owned' by anybody! Mathematics belongs to God" (Knuth, 1999, p.8).

When he completed the initial version in 1979, he published full details (Knuth, 1979), and when its was finished he published complete, documented source code (Knuth, 1986). Knuth's motivation was concern for progress, but in contrast to Gates, he thought that maintaining proprietary control would hinder progress: "The whole business of typesetting was being held back by proprietary interests ... pretty much there would be no progress" (Knuth, 1999; Levien, 2000, p.16).

Knuth valued the quality of his books above the monetary gain from having them published, and he did not assert control over others' use of his program because he was frustrated about the effect of propriety control on progress. Eric Hoffer (1951) identified *frustration* as the originating principle of mass movements and the hacker most famously frustrated by the rise of proprietary control was Richard Stallman.

2.3 RICHARD STALLMAN, THE LAST HACKER

In the early 1980s the microcomputer boom collapsed the once-vibrant AI Lab community. Levy (1984) described the migration of the AI Lab staff to two competing companies, Symbolics and Lisp Machines, as a personally hostile period that politicised Stallman against proprietary control of software; he became the last hacker left at MIT from the 1970s set. However the biography of Stallman by Williams (2002), which is strongly influenced by him, focuses on a less personal and more practical event as that which politicised him.

Stallman had been employed for 15 years at the AI Lab to make incremental improvements to the lab's software. During his final year at MIT in 1983, Xerox donated a prototype network laser printer to the lab, but with only binary copies of the printer's driver software. Programs made proprietary like this were unusual at the AI Lab at the time. Without the source code corresponding to the binary driver software, Stallman was unable to do his job.

This was frustrating because the printer was a prototype and often jammed. While visiting Carnegie Mellon university's computer lab, Stallman met the engineer who had written the software and requested a copy of the source code. His request was refused because the engineer had signed a 'Non Disclosure Agreement' (NDA) with Xerox, another way of maintaining proprietary control that was unusual at that time at the AI Lab (Williams, 2002, p.4–9).

The biography says this event caused Stallman to clarify his thoughts about the values of the hacker culture (Williams, 2002, p.10), but it was the retirement of the mainframe system he had worked on for

the previous 15 years that provided the final impetus to reassert these values with the 'GNU project' (Williams, 2002, p.91).[4]

4 Thus Stallman frames the free software movement as a *reform* movement: "We did not call our software 'free software,' because that term did not yet exist; but that is what it was." (Stallman, 1999b, p.53).

3 THE FREE SOFTWARE MOVEMENT

3.1 THE GNU PROJECT

On September 27th, 1983, Stallman posted a message to the `net.unix-wizards` Usenet newsgroup that proposed writing "GNU," a complete operating system and suite of applications with no proprietary components.[5] GNU would include existing programs that were unrestricted, such as TEX and the X window system,[6] and would create all the other necessary parts.

The announcement explained his motivation for such a large undertaking in terms of ethics:

> I consider that the golden rule requires that if I like a program I must share it with other people who like it. I cannot in good conscience sign a nondisclosure agreement or a software licence agreement.
>
> So that I can continue to use computers without violating my principles, I have decided to put together a sufficient body of free software so that I will be able to get along without any software that is not free. (Stallman, 1983)

The 'golden rule' referred to is the ethical principle of reciprocity, recognised by all major world religions and known in the Occident by the Biblical phrase "do to others what you would have them do to you" (Matthew 7:12).

This shows Stallman's clarification of the informal 'hacker ethic' into a formal rationale based on ethical principle. While the reciprocity principle also underlies Gates' assertion that sharing software is unfair, the other principle that motivates Stallman it that of a free society. He believes it is unjust for software developers to have total power over their users because as computers come to control more and more activities in society, non-free software creates a non-free society:

> Schools should teach their students to be citizens of a strong, capable, independent and free society. And this means teaching them to use free software, not proprietary software. (Rubini, 2007)

5 GNU is an acronym for "GNU's Not Unix," chosen because it explained it was modelled on AT&T's popular but operating system Unix, but was not in fact Unix, since Unix was propriety. First designed in 1969 (Raymond, 1996, p.460), Stallman chose Unix as a model because it was modular and could run on many heterogeneous systems, and users familiar with Unix would be able to easily switch to GNU.

6 The X Window System is a networked graphical user interface system originating from MIT in the early 1980s, and like TEX continues to be developed and used widely today.

Stallman's proposal solicited donations of hardware, money, software and work. All were forthcoming so he quit his job at MIT and the following year published the 'GNU Manifesto' (Stallman, 1984) and set up the 'Free Software Foundation' (FSF) to receive donations in a tax deductible way and administrate the project.

3.2 FREE SOFTWARE DEFINED

In the English language there is some ambiguity inherent in the term "free software," because 'free' can refer to freedom or to price. In the anglophone consumer culture of the late 20th century the latter meaning is the default, though it is unambiguous in other languages, such as "logiciel libre" in French.

Today the FSF website notes that in the initial announcement "several of the details about [the term] free software had not yet been clarified" (Stallman, 1983) and now provides the 'free software definition' that Stallman refers to as 'the four freedoms':

> - The freedom to run the program, for any purpose (freedom 0).
> - The freedom to study how the program works, and adapt it to your needs (freedom 1). Access to the source code is a precondition for this.
> - The freedom to redistribute copies so you can help your neighbor (freedom 2).
> - The freedom to improve the program, and release your improvements to the public, so that the whole community benefits (freedom 3). Access to the source code is a precondition for this.
>
> (Free Software Foundation, 2008a)

All computer users are able to directly exercise freedoms 0 and 2, but studying how a program works and adapting it implies that one must be a programmer to benefit from all of these freedoms. However there are many aspects of programs that are not programmatic, such as the text of the user interface. Free software user interfaces can be freely translated into any language, so monolingual minority language users can run the programs.

In this way all individuals do benefit indirectly when everyone in society has these freedoms. If a modification does require a programmer, non-programmers can hire any programmer they choose to exercise these freedoms on their behalf.

3.3 FREE SOFTWARE BUSINESSES

When software does not come with such freedoms, it is accurately referred to it as 'proprietary' or 'non-free' instead of 'commercial.' Yet free software is often developed on a commercial and for-profit basis (Friedman, 2005, p.97).

Free software is often mistakenly referred to as 'non-commercial' though. Since everyone is free to develop a free program in their leisure time, there is a 'long tail' power law distribution of commercial and hobbyist development, and the hobbyists can be more visible.

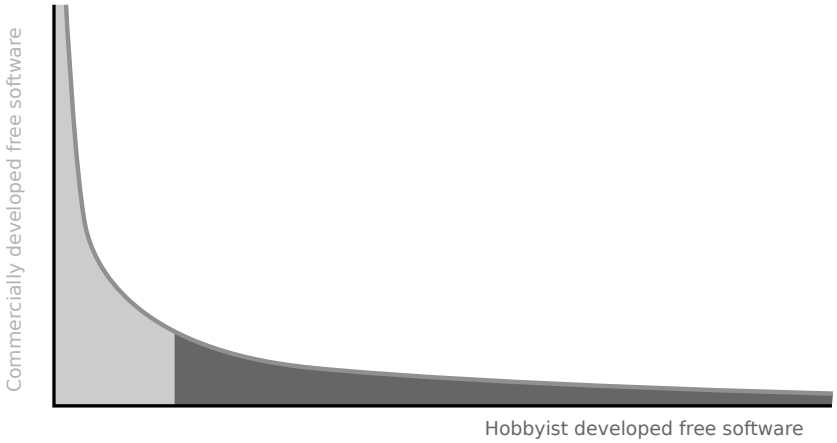


Figure 1: The long tail of commercial and hobbyist free software development

Additionally, freedom to redistribute a program has direct implications for the standard business model of software developers that Gates defended in 1976.

The GNU Manifesto included suggestions about how programmers could make a living while permitting unrestricted redistribution and improvement:

> There are plenty of ways that programmers could make a living without selling the right to use a program. This way is customary now because it brings programmers and businessmen the most money, not because it is the only way to make a living. It is easy to find other ways if you want to find them. Here are a number of examples.
>
> A manufacturer introducing a new computer will pay for the porting of operating systems onto the new hardware.
>
> The sale of teaching, hand-holding and maintenance services could also employ programmers.
>
> People with new ideas could distribute programs as freeware,[7] asking for donations from satisfied users, or selling hand-holding services. I have met people who are already working this way successfully.

7 The term 'freeware' has since become established as redistributable but non-modifiable software and is no longer synonymous with free software.

> Users with related needs can form users' groups, and pay dues. A group would contract with programming companies to write programs that the group's members would like to use. (Stallman, 1984, p.38)

The final item in that list can be seen as the principal activity of the FSF until the late 1990s. The Foundation received large donations annually, starting with $10,000 in 1987 (Goldstein et al., 1988, p.4), and $250,000 in 1989 (Arceneaux et al., 1988, p.5), and used these to funds to hire programmers.[8]

As the project progressed, contributors soon started developing GNU software on a for-profit basis. In 1987 the FSF began supporting this by maintaining a 'service directory' that listed people offering services, such as "answering questions for new users, customising programs, porting to new systems, or anything else" (Rubin, 1987).

In 1989 some of GNU contributors founded a start-up, Cygnus Support, "the first for-profit corporation that provides commercial support *only* for free software" (Kingdon et al., 1990, p.10). This was the maintenance business model Stallman suggested in 1986, founded because there were "so many requests for paid support" of the GNU project's software development tools (Hudson, 2008).

These tools were centered around the GNU C Compiler (GCC), a large and complex program that converts the source code that people write into binary code that computers run (Puzo, 1987, p.5).

In 1986 Stallman wrote the first complete version of GCC on his own, having never written a compiler before. It was considered excellent quality by other hackers, cementing his reputation in the hacker community as "the greatest hacker who ever lived" (Moody, 2001, p.30).

In 1987 Michael Tiemann extended the C compiler into a C++ compiler, while working at "the Microelectronics and Computer Technology Corporation (MCC), a consortium established in 1982 to do long range research for around 20 shareholder companies"—the same business model as the FSF (Goldstein et al., 1988, p.9).

Tiemann was particularly aware of the business potential of free software, stating that for many the GNU manifesto "read like a socialist polemic, but [he] saw something different ... a business plan in disguise" (Tiemann, 1999).

Cygnus took off when they began additionally pursuing the first business model Stallman outlined in 1986, porting GNU software to new hardware. Cygnus developed marketing material around the concept of free software to appeal to large corporate customers; the company slogan was "making free software affordable." As part of these efforts Cygnus published a 'Free Software Report' and the first issue explained free software in economic terms:

> Nobel laureate John Maynard Keynes proposed the theory that free markets were more efficient than artificial markets. The

8 The FSF's income in 2006 was $832,175 (Charity Navigator, 2008) and it no longer hires programmers because of the commercial free software development market.

> balance sheet of what is left of the Soviet Union tends to bear this out. The inherent economics of software are that software is expensive to produce and maintain, but cheap to duplicate. This is not well represented by traditional software offerings, where development costs are rarely cited, and duplication is severely restricted.
>
> By charging for production and maintenance and offering the freedom to duplicate, free software behaves like an ideal commodity in the free market. In contrast, proprietary software depends on a state-supported monopoly (copyright) to support prices, and thus behaves like a controlled commodity in an artificial market. (Thatcher, 1992, p.1)

Cygnus was successful at engaging lucrative corporate contracts and became the largest free software company of this period, easily comparable to most successful proprietary software businesses.

In 1998 it had a compound annual growth rate greater than 65% since 1992; had been listed on the San Jose Business Journal's Top 100 Fastest Growing Private Companies list three years in a row; ranked on the "Software 500" list of highest revenue software businesses in the world (Tiemann, 1999, p.71).

That year it had annual revenues over $20,000,000, employed more than 120 people, and was sold to Red Hat for $600,000,000 making all the early employees into millionaires (Gilmore, 2006).

Tiemann has stated that a key aspect of Cygnus' success was the innovative approach to licensing GNU software, 'copyleft' (Wayner, 2000, p.194).

3.4 GPL AND STRONG COPYLEFT LICENCES

Prior to the GNU project, software was typically made free by dedicating it to the public domain. But GNU software was instead distributed under a 'copyleft' copyright licence, the GNU General Public licence (GPL, Appendix B.1). The June 1988 newsletter explained what both were, and why they were used:

> [Public domain software] allows anyone to copyright and restrict its use against the author's wishes, thus denying others the right to access and freely redistribute it. This completely perverts the original intent.
>
> A copyleft is a legal instrument that makes everybody free to copy a program as long as the person getting the copy gets with it the freedom to distribute further copies, and the freedom to modify their copy (which means that they must get access to the source code). Typical software companies use copyrights to take away these freedoms; now we software sharers use copylefts to preserve these freedoms.
>
> The copyleft used by the GNU project is made from a combination of a copyright notice and the GNU General Public licence. The copyright notice is the usual kind. The General Public licence is a copying licence which basically says that you have

> the freedoms we want you to have and that you can't take these freedoms away from anyone else. (Tower et al., 1988, p.4)

When a software developer plans to include a new feature in their program, they are faced by a 'build or buy' scenario; they can either write the new feature internally, or they can integrate existing 'library' code from a third party.[9]

Licensing a proprietary library can be cheaper and faster in the short term, but cedes some control over a business to its suppliers which may be unacceptable. Over the long term suppliers can become less cost effective or even go out of business. Costs can be cut and development hastened while retaining full control by integrating free software.

But if the developer's business model depends on prohibiting sharing and further modification, the GPL blocks them. Although from a lay-person's perspective the developer's software is separate from the integrated component, under copyright law the whole combination is considered a 'derived work' of the GPL part.

Therefore either it must be licenced under the GPL, or it must not be distributed at all. Many programmers find this contentious (Kennington, 2006) and Microsoft Senior Vice President Craig Mundie has criticised it:

> This viral aspect of the GPL poses a threat to the intellectual property of any organization making use of it. It also fundamentally undermines the independent commercial software sector because it effectively makes it impossible to distribute software on a basis where recipients pay for the product rather than just the cost of distribution. (Mundie, 2001)

Mundie's comments contrast with the experience of Cygnus, who were fundamentally supported by the GPL: It meant that their customers would benefit from improvements commissioned by Cygnus' other customers, and that when their competitors won a contract, the client would publish the source code for their version when their product shipped, so that "all the new features and insights developed by competitors would flow directly back to Cygnus" (Wayner, 2000, p.194).

3.5 BSD AND NON-COPYLEFT LICENCES

The GPL acts as a lever to "ensure cooperation," something of paradox (Ray, 2008b), which leads to a philosophical contention: Copyleft is a restriction. Although the GPL is intended "to protect your rights

9 In this context a library is a program designed for use as a component in a larger program, although any program can be integrated into any other if its source code is available.

[and to] forbid anyone to deny you these rights or to ask you to surrender the rights" (Appendix B.1), some say that despite that intention the GPL is restrictive so it is not truly free. The figurehead for those with this view is the BSD project.

Programmers at The University of California Berkeley's Computer Systems Research Group had vigorously improved AT&T's Unix into the 'Berkeley Standard Distribution' (BSD), which included early Internet access software.

Stallman visited California to persuade the Berkeley programmers like Keith Bostic to make the non-AT&T parts free software,[10] so that they could be used in the GNU system (Williams, 2002, p.129).

In 1989 this happened and the programmers at Berkeley decided to rewrite all the AT&T parts to release their own free software Unix operating system.[11] However, they used the 'BSD licence,' (Appendix B.2) not the GPL.

The BSD licence permitted modification and redistribution in source code or binary form, and the only conditions were to give attribution without endorsement.[12] This meant that such software could be used as part of a proprietary program.

Therefore proprietary software developers prefer simple all permissive licences like the BSD licence. For example the X Window System developed at MIT in the early 1980s was always made available under the 'MIT X11' licence because it was funded by a consortium of proprietary Unix vendors.

By the late 1980s many programs for proprietary Unix systems were being released as free software, often related to Internet services: 'BIND' underpinned the domain names system that ties human address names like `www.gnu.org` to machine address numbers like `199.232.41.10`; 'Sendmail' underpinned the Internet's email system; and later 'Apache' would become the most popular web-server program.[13]

New 'scripting' programing language systems such as Perl and Python were released as free software, too. But all used their own non-copyleft licences, signalling their independence from the GNU project (Raymond, 2001, p.70).

10 "We'd go to dinner afterward and continue arguing about copyright over dinner." (Williams, 2002, p.129)

11 A complete free software Unix system was developed at Berkeley, but was not publicly available until the mid 1990s because of legal disputes with AT&T.

12 These conditions required any advertising for derived works to say "this product includes software developed by the University of California, Berkeley and its contributors." This meant that, just as the GPL blocked proprietary software developers from integrating GPL programs, the BSD licence blocked developers using the GPL from integrating those programs. Thus the MIT X11 licence, which is similar but without that clause, is used by many free software projects. In 1999 this was resolved when that clause was removed (Appendix B.2).

13 The Apache licence was also not compatible with the first two versions of the GPL. Despite being a non-copyleft licence, it contained legal requirements that responded to rising the threat to free software posed by software idea patent litigation. However the third version of the GPL has provisions for becoming compatible with more licences (Appendix B.5).

3.6 LGPL AND WEAK COPYLEFT LICENCES

In 1991 the second version of the GPL was published, followed by a 'Library GPL' (LGPL) (Appendix B.3; B.4). The second GPL contained only small adjustments,[14] but the LGPL was substantially different.

If a proprietary software developer wants to add a feature to their program, they may be unwilling to use a library licenced under the GPL. However, they might be willing to use a free software library if their parts of the combination remain under their own licence.

Libraries can be enhanced to better integrate with specific programs. The LGPL requires that if an improved library is distributed, developers must also make the source code for these improvements available to their users. It also requires developers to provide the means for users to run the program with their own modified versions of the library.

Thus the 'weak' copyleft of the LGPL is a tactical compromise to encourages proprietary software developers to contribute partially to the free software movement.[15]

At this point Stallman had succeeded at conserving the 1970s hacker culture as the 'free software movement,' a social movement to write free software larger than the GNU project and independent of it.

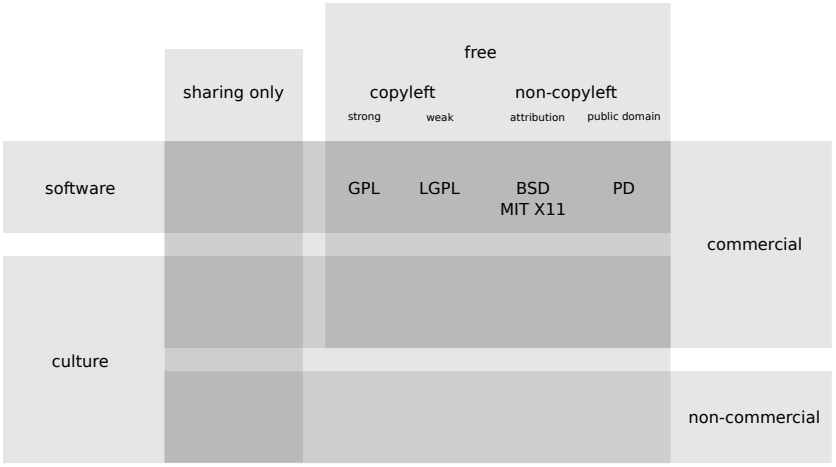


Figure 2: The spectrum of copyleft in major free software licences

14 The largest differences were the additions of new legal requirements that responded to rising the threat to free software posed by software idea patent litigation.

15 This tactical nature was highlighted in 1999 when the licence was renamed the 'Lesser GPL' because "it does Less to protect the user's freedom than the ordinary General Public licence" Free Software Foundation (1999).

4 THE OPEN SOURCE MOVEMENT

4.1 THE LINUX KERNEL

After quitting his job at MIT to start the GNU project, Stallman had earned a living by distributing GNU software and manuals; with GNU underway the FSF took over his distribution business and he did commercial development of GNU programs. GNU contributors saw this as the way they would earn a living, as Stallman could earn $100/hour (Lord, 2007).

In 1991 Stallman was awarded a MacArthur Fellowship "genius grant" income award that totalled $240,000 (Moody, 2001, p.28). The award was invested in mutual funds to give him a secure lifetime income so he could dedicate himself fully to the movement. It also enabled him to travel more to give lectures about free software around the world.

By 1991 the GNU project had developed working programs for all the necessary parts of an operating system, except a one—a 'kernel.'[16] But the GNU kernel, 'HURD,' suffered numerous problems and never became compelling enough to attract intensive development as other GNU programs had done (Appendix A.1).

In 1991 Linus Torvalds, a computer science student at the University of Helsinki, attended one of Stallman's lectures (Torvalds, 2001, p.58). That year he became frustrated that Unix was priced outside the reach of an undergraduate student, so in order to run Unix on his microcomputer, he started developing a kernel in his spare time[17]: 'Linux' (Williams, 2002, p.136).

Torvalds developed Linux with a simple design that was complemented by Torvald's unusual style of project management: He was willing to accept any 'patch'[18] emailed to him if it worked (Moody, 2001, p.80). This meant a loose knit community quickly formed around the project. Many patches were sent to him and there was unusually rapid progress.

The licence of the Linux kernel was not initially free software because it included an anti-commercial restriction, but Torvalds adopted the GPL in 1992. This meant a complete operating system that was totally free software was finally possible. With the commercial restriction removed, dozens of individuals in the Linux community combined the GNU system with the Linux kernel and other programs that would run atop the combination.

16 A kernel is a core operating system program that connects all other programs to the hardware, and is particularly complex.

17 "Linux is ... just a hobby, [not] big and professional like gnu" (Torvalds, 1991)

18 A patch is a text file that represents the differences between two version of the same source code file; ideal for contributing improvements.

4.2 GNU/LINUX DISTRIBUTIONS

A cottage industry formed around selling these complete systems, which the distributors called 'Linux distribution' (Moody, 2001, pp.88–100). This is synecdochal since Linux is an operating system kernel, not a complete operating system.

Stallman asked for the complete system to be called 'GNU/Linux' to give a fair representation of the systems origin, and call attention to the GNU project's goal of opposing proprietary software (Stallman, 2008). But this was generally ignored since the developers of most distributions *wanted* to include proprietary programs, not reject them.

With many Internet service programs already existing as free software, GNU/Linux quickly matured into a fully-featured Internet server system. This shifted the distribution cottage industry from selling copies of GNU/Linux for a small distribution fee to selling installation support and long term maintenance contracts. The largest company to emerge from this activity was Red Hat, which today has 2,200 employees worldwide, $400,000,000 annual revenue and $60,000,000 annual profit (Red Hat, 2007).

Ian Murdock was frustrated that the initial distributions did not reject proprietary software like the GNU project, and were not developed collaboratively at a fast pace like the Linux project.

In 1993 he started the Debian project to do so.[19] Collaboration was facilitated by Debian's 'package management' software,[20] where individual contributors took ownership of a particular program and created a package that would fit together cleanly with the rest.

Creating a wholly-free GNU/Linux distribution would finally reach Stallman's goal of a complete operating system with no proprietary programs, so the FSF funded Ian to work full time on Debian for 6 months, delegating the job of shipping GNU (Appendix A.1).

But the FSF and the early Debian developers fell out over a technical disagreement and Debian set up its own charitable foundation, 'Software in the Public Interest, Inc' (SPI).

Debian has since operated entirely independently of the FSF in a democratic manner (Moody, 2001, p.92). The processes for democratic collaboration at such a large scale were developed throughout the 1990s, and the principles were chartered in the 'Debian social contract' by Bruce Perens in 1997 SPI (2004). A key part of the social contract is the 'Debian free software guidelines,' which make explicit many of the implications of the FSF's free software definition.

Today Debian is the largest project within the free software movement, billing itself as 'the universal operating system.' Over 18,000 packages are maintained by over 1,000 voting members and these

19 Debian distributes proprietary software packages, but does not consider those packages part of Debian (Debian, 2004).

20 Package management software allows users to upgrade a system and make incremental updates to individual programs with ease.

packages that work in a uniform way from mobile phones to supercomputers (Debian, 2008).[21]

This size and reach is achieved with little money compared to corporate distributions. SPI (2008) reports Debian spent $194,495.81 and received $258,490.94 in 2007. This is because Debian is created by volunteers who earn a living disconnected from Debian, ranging from self-employed consultancy[22] to employment at large technology corporations like Pixar and Hewlett-Packard.

The most visible and popular distribution with individuals today is Ubuntu. In 2004 dot-com millionaire Mark Shuttleworth founded Canonical and the Ubuntu project to make a derivative of Debian focused only on common laptop, desktop and server hardware.

Canonical sells support services for Ubuntu to individuals and corporations, and Ubuntu is released every 6 months and focuses on providing a operating system competitive with the latest versions of Windows and Mac OS X thanks to the graphical desktop systems, KDE and GNOME (Canonical, 2008; Hill, Bacon, Burger, Jesse and Krstic, 2006).

4.3 KDE AND GNOME

In contrast to its server capabilities, GNU/Linux desktop software took a long time to mature. The GNU project had always planned to develop a full graphical desktop environment akin to Windows 95 and Mac OS. But like the HURD, efforts in 1990 and 1994 had stalled (Stallman, 2001).

In 1995 the first large GNU program with a graphical user interface (GUI), the GNU Image Manipulation Program (GIMP), was developed by two Berkeley students in their spare time. Spencer Kimball and Peter Mattis wanted to replicate Adobe Photoshop, and began with a proprietary 'toolkit'[23] but quickly developed their own 'GIMP ToolKit' (GTK), released under the LGPL.

In 1996 a student at the German university of Tübingen, Matthias Ettrich, developed a word processor based on TEX as a course project. For this he used the 'Qt' toolkit from the start-up Trolltech. Despite that the source code was published, it was proprietary software, but Ettrich used it because it was technically advanced and allowed him to develop his program quickly.

This success motivated him to initiate the development of a free software desktop environment based on Qt, 'KDE.' His Usenet announcement attracted contributors and they reached a consensus that they would prefer Qt's practical benefits over less advanced but free alternatives, but for their own programs they would adopt the GPL (Moody, 2001, p262).

21 While not referring to Debian specifically, a list of supercomputer operating systems gives GNU/Linux 5.6% market share in 2000 and 84.6% in 2007 (Top500.org, 2007).

22 Phil Hands is been a long-time Debian consultant whose `http://www.hands.com` homepage states his daily rate is "£1075 + VAT + expenses."

23 A toolkit is a library for constructing GUIs.

As the KDE project became popular, the GNU project contributors objected to KDE's dependency on Qt because it was proprietary, and responded in three ways: Stallman approached Trolltech and suggested that a free software business model could work for them;[24] a direct replacement for Qt was initiated; and a third GNU desktop environment based on GTK was developed: GNOME.[25]

4.4 OPEN SOURCE

The KDE project's decision to accept a proprietary dependency, most distributions' inclusion of proprietary software, and the many free software programs released under non-copyleft licences, are all indicative of split in the free software movement: Many do not agree with the FSF that proprietary software ought to be rejected and opposed.

In 1997 Eric Raymond published a paper "The cathedral and the bazaar" and presented it at one of the first large free software conferences, in Germany. Brooks (1978) famously wrote that large programming projects achieve the highest quality and are done fastest in small teams. He stated this was because complex programs require planning and coordinating programmers takes time. Raymond noted the way that the Linux kernel was developed by a large team and yet was a complex, high quality program that was progressing rapidly, discrediting Brooks.

Tim O'Reilly is the founder of technical publisher O'Reilly Media. The company had been successful in the 1980s publishing third party documentation for Unix programs, such as the best selling O'Reilly manual for the Perl programming language. He invited Raymond to present his paper at the first O'Reilly Perl conference, and shortly after convened a 'summit' of influential hackers, including Raymond and the primary developers of the popular free Internet server programs—but excluding Stallman (Moody, 2001, p.166). The summit sought to coin an alternative term for free software: 'Open source."

A charitable foundation, the 'Open Source Initiative,' was formed, and a trademark registration application was filed. In practice both terms describe exactly the same kind of software; the term was defined by Perens for the Open Source Initiative's 'open source definition' by adapting the 'Debian free software guidelines' without making any major changes (Moody, 2001, p.168) (Perens, 1999).

The new term was presented to the free software community as a necessary clarification of the ambiguity in the word 'free'[26] (Raymond,

24 In 2000 Qt was released under the GPL for GNU/Linux (Stallman, 2002a, p.28) and today is also available for Windows and Mac OS X. GTK is available under the LGPL for GNU/Linux and Windows and while the Mac OS X version is under development as a prototype.

25 The GNOME project established its own charitable foundation, The GNOME Foundation, and operates somewhat separately from the GNU project.

26 This was immediately criticised as vulnerable to co-option and countered with the suggested term 'software freedom' (Tower, 1998).

1998). But it was also intended for those who do not view proprietary software as unjust "to distance themselves from the FSF" and its political motivation (Torvalds, 2006). This meant free software could be presented to the corporate business community without sociopolitical dissent over proprietary control.[27]

Shortly after the summit, the proprietary web browser developer Netscape made a radical announcement: To compete with Microsoft's 'Internet Explorer' browser, it would publish the source code of its browser as 'open source.' This eventually resulted the most popular alternative to Internet Explorer, Mozilla Firefox (Refsnes Data, 2008).

With Netscape in the press and O'Reilly's influential support, the term soon became established and the 'open source movement' emerged as distinct from the free software movement. The difference is in their motivations, since they work towards the same aim. The open source movement is motivated by Raymond's ideas that through peer review, free software inevitably leads to reliable, secure, fast, powerful and convenient software.

27 "It was about giving businesses a better story to tell their customers than 'We faithfully contribute all our patches back to some guys who are out to smash proprietary software."' (Lord, 2007)

5 THE FREE CULTURE MOVEMENT

5.1 FREE SOFTWARE MANUALS

The GNU project had from the start been writing documentation for its programs and making it available under the GPL or a simple copyleft licence (Stallman, 1983, 1999b). O'Reilly benefited from establishing the open source movement because its rhetoric avoids the implication that if a program is changed, the manual accompanying it ought to take into account those changes.

In 1996 Stallman had published an article promoting the writing of free manuals, and while he did not name O'Reilly Media, he did mentioned proprietary Perl manuals as his primary example (Stallman, 1996). In 2000, he continued this effort to encourage the publication of free software manuals by developing a copyleft licence specifically for commercial manual publishers (Stallman, 2000b): The 'GNU Free Documentation licence' (GFDL) (Free Software Foundation, 2000).

Since the GFDL accommodated publishers, its terms are controversial in the free software community. The primary criticism is that it allows for 'invariant' sections which cannot be modified or removed (Nerode, 2003).[28]

Stallman's rationale for this was that works "should be distinguished not by media, but by the way the works contribute to society" (deVilla, 2007). GNU manuals contained functional information about programs that ought to be modifiable, and also political essays promoting the GNU project's goals. In Stallman's view it would not contribute to society if his essays were modified because that would misrepresent him.

5.2 STALLMAN'S THREE CATEGORIES

At this time Stallman also began to give speeches about how the principles of software freedom applied to other kinds of works. Since starting the GNU project, he had often been asked how software freedom might apply to other areas, such as hardware. Since physical objects cannot be copied without factories, and since modification of your own property is limited only by feasibility, Stallman states that the principles of free software do not apply to physical objects.

However, many kinds of works are not physical, and subject to copyright. He proposed a broad theory of compromises between the

28 In 2002 version 1.2 of the licence was published in response to some of this feedback (Free Software Foundation, 2002) and in 2006 the Debian project voted that GFDL works are only free if they do not have invariant sections (Debian, 2006).

'no rights reserved' public domain and the 'all rights reserved' copyright default, starting the 'free culture movement' (Stallman, 2000a).

Copyright law already distinguishes between different kinds of works and arranges different copyright bargains for each kind. Stallman characterises copyrighted works into three categories, based on a work's purpose for its users: to function, to witness, and to entertain. These categories can be explained by example:

Works that are practical and functional: Software programs and corresponding manuals, culinary recipes, reference works such as encyclopedias, dictionaries, textbooks and species taxonomies, geographic maps, educational material, designs of equipment and buildings.

Works that witness the thoughts of certain parties: Essays, scientific papers, political manifestos, personal diaries and memoirs.

Works that are artistic, aesthetic, or entertainment: Novels, theatrical scripts, music, cinema, television drama, paintings,

Stallman believes that the general public should always be able to non-commercially redistribute works verbatim (Appendix A.4); that functional works should always be commercially redistributable and modifiable; that witnessing works should not be modifiable; and that artworks should only be restricted in their commercial use, redistribution and modification for a short period of 10 years (Stallman, 2002b; deVilla, 2007).

5.3 WIKIPEDIA

In 1999 Stallman begun promoting the idea of a free encyclopedia that would be written by school teachers (Severance, 1999; Stallman, 1999a). Two people contacted Stallman for advice on their projects to do this, GNUpedia and Nupedia, and the projects eventually merged. Nupedia was the larger effort and had an expert review panel process, but was proceeding slowly with less than 24 articles in the first year. To hasten development, the chief editor Larry Sanger adopted a new kind collaborative authoring software, a 'wiki' (Sanger, 2005).

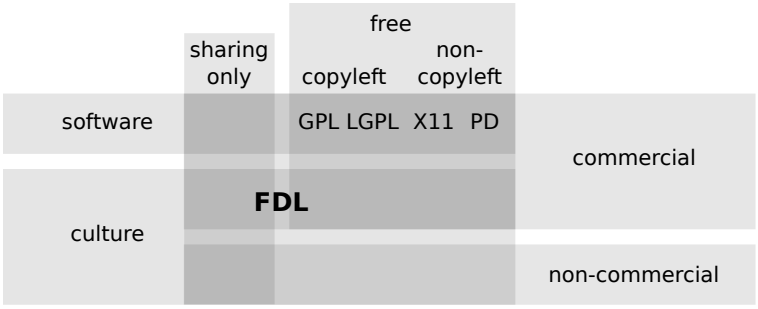


Figure 3: The GNU Free Documentation licence in relation to free software licences.

A wiki is a website revision control system for radical collaboration: They allow all visitors to edit the text of pages, even anonymously. This anarchy allows fast progress because it allows visitors to immediately correct errors of omission or fact. It is not degenerative because all edits are saved incrementally, so vandalism can be instantly reverted.

The wiki part of Nupedia was licenced under the GFDL and in January 2001 it was split from Nupedia and renamed Wikipedia. Wikipedia grew quickly, with over 13,000 English articles within one year (Sanger, 2005). Today it has more than 2,534,000 English articles and millions more across 322 languages (Wikimedia Foundation, 2008) and is the 8th most popular website globally (Alexa Internet, 2008); Wikipedia is the largest and most visible project within the free culture movement.

Sanger's (2005) account of the origins attempts to explain "why Wikipedia started working." However Clay Shirky (2008) has explained the success of Internet-based collaboration overall in terms of radically collapsed 'transaction costs.' Shirky states that while Coase (1937) explained how effective management lowered the transaction costs of doing business to create successful firms, management itself is a transaction cost. Since computer networks reduce transaction costs, the cost of management can in some situations outweigh its benefit:

> Loosely coordinated groups can now achieve things that were previously out of reach for any other organizational structure, because they lay under the Coasean floor ... Prior to the current era, the alternative to institutional action was usually no action. Social [network] tools provide a third alternative: Action by loosely structured groups, operating without managerial direction and outside the profit motive. (Shirky, 2008)

Like Debian, despite its size Wikipedia is operated with relatively little money; the Wikimedia Foundation (2006) reported its expenses were $56,666 in 2004, $201,418 in 2005 and $716,132 in 2006, of which $107,122 were salaries and wages that year.

5.4 CREATIVE COMMONS

In 2002 a law professor at Stanford, Lawrence Lessig, tried to challenge the US Copyright Term Extension Act of 1998 in the Supreme Court. The amendment retroactively extended copyrights by 20 years, ensuring that Micky Mouse did not lapse into the public domain—substantially reducing it (Levy, 2002). Lessig lost the case, but the William and Flora Hewlett Foundation gave Lessig $1,000,000 to launch Creative Commons (CC) (Lessig, 2008).

Creative Commons aims to bridge the public domain by providing a range of general purpose copyright licences for all kinds of works that authors could easily apply. Today there are six licences

that all require attribution and permit worldwide non-commercial verbatim redistribution, but vary the terms of modification:

- Attribution (CC-BY) permits any modification
- Attribution–NonCommercial (CC-BY-NC) permits any modification, non-commercially
- Attribution–ShareAlike (CC-BY-SA) permits any modification with a weak copyleft akin to the LGPL
- Attribution–NonCommercial–ShareAlike (CC-BY-NC-SA) permits any modification with a weak copyleft akin to the LGPL but all use must be non-commercially
- Attribution–No Derivations (CC-BY-ND) permits no modification
- Attribution–NonCommercial–No Derivations (CC-BY-NC-ND) permits no modification and verbatim redistribution can only be done non-commercially
  (Creative Commons, 2008)

These effectively implemented Stallman's theoretical framework, and he initially endorsed the project; the licences soon became massively popular and by 2007 tens of millions of works had been published with them (Cheliotis, 2007). However, the project also came to be criticised.

5.5 FREE CULTURE DEFINED

In 2004 Lessig published a book titled "Free Culture" (Lessig, 2004). The book examined the way new media technologies disrupted existing media businesses historically, and compared that to the contemporary situation where existing businesses seek to disrupt computer network technology. But it left the precise meaning of the term 'free culture' undefined.

The widest possible definition appeared to encompass anything permitting non-commercial redistribution, since the Creative Commons licences had that in common. But even this came into question when Creative Commons began promoting additional licences that did not permit non-commercial verbatim sharing worldwide in 2004 (Haughey, 2006a). Stallman found this unacceptable and withdrew his support until they were retired (Stallman, 2005). He also criticised the way the branding strategy promoted the overall brand ambiguously.

The non-commercial licences are the most popular, but also the most controversial for the commercial free software community.[29]

29 The Debian project also considered many small terms of the licences problematic (Haughey, 2006b) but these were resolved with the current 3.0 release of licences.

Myers (2008a,b,c,d) suggests copyleft mitigates exploitation and non-commercial restrictions are too limiting; Ray (2008a) said they create a "creative flowerbed" rather than a commons. But Lessig (2006) defended them, stating that allowing people to choose terms that they believed were best without being prescriptive was crucial.

Benjamin Mako Hill (2005) criticised the lack of a definition[30] and in 2006 co-initiated the development of the 'Definition of Free Cultural Works' (DFCW). This defined the label "free culture" in terms equal to the FSF free software definition, generalised away from software and with more detail akin to the Debian free software guidelines (Hill, Möller et al., 2006).

Creative Commons responded positively to all these criticisms. It developed licence-specific branding, retired the non-redistribution licences, and endorsed the DFCW. Thus today it is clear that only the CC-BY and BY-SA licences contribute to free culture (Linksvayer, 2008).

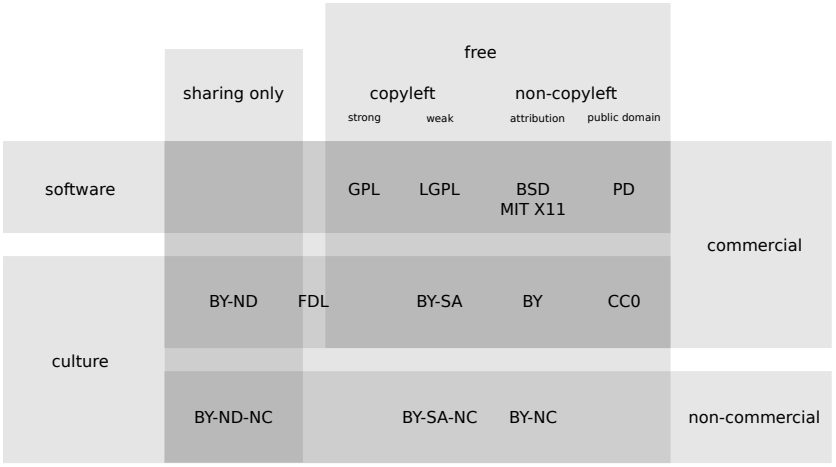


Figure 4: The relation of free software and Creative Commons licences.

30 "CC sets no defined limits and promises no freedoms, no rights, and no fixed qualities. Free software's success is built upon an ethical position. CC sets no such standard." (Hill, 2005)

Part B

IMPLICATIONS FOR TYPEFACE DESIGN

6 SHOULD TYPEFACE DESIGNS BE FREE?

6.1 WHAT ARE TYPEFACES?

To explore the implications of free culture for typeface design, what a typeface design is must be established. The etymology of the word 'typeface' comes from the 'Gutenberg' printing technology of medieval Europe, where a 'type' was a small long metal cuboid with the shape of a letter in relief on one 'face' of the cuboid. These types were arranged and bound into blocks, ink spread on the typefaces, and the block pressed onto paper to create a print.

'Calligraphy' is stylised hand-writing that harmoniously relates the shapes of letters to make them look like they belong together. The shapes of the letters initially mimicked the calligraphy of the time and were created through a process known as 'punch cutting' (Smeijers, 1996). As printing technology developed, the letter shapes on type faces diverged from calligraphic shapes, although they tended to retain elemental forms derived from the structural characteristics of human hand-writing such as contrast (Noordzij, 2005).

Printing technology has developed using a variety of media and processes, so the precise definition of a typeface can be unclear. In the community surrounding Knuth in the early period of digital typography, Richard Southall (1985, p.5–9) provided a precise set of definitions.

A 'character' is the abstract essence of a letter, separated from its visual shape. A 'glyph' is the inverse, a shape of a letter separated from its abstraction; the Latin character 'a' has two glyphs, 'a' and 'A.' A script is "a set of characters used to write one or more languages" and a typeface as "a set of distinctive, visually related shapes that represent some or all of the characters of a script."

These sets of shapes are abstracted from any particular medium; the same typeface can be expressed in many different kinds of media: metal, wood, or digitally. Thus Southall distinguishes a font from a typeface; a font is "a set of character shape specifications, on one or more image carriers, that corresponds to the character shapes of a particular typeface." 'Image carriers' are "the means by which the shapes ... are specified."[31] That is, a font is the concrete implementation of a typeface in a particular technology. Since typefaces and fonts are theoretically discrete, fonts are considered separately in the next chapter.

31 Metal types are 'specified' in a direct physical way with punches, but since Linn Boyd Benton's pantographic punch-cutting machine, patented in 1885, specifications have existed as drawings that are mechanically processed (Kinross, 2004, p.41)

6.2 STALLMAN'S THREE CATEGORIES

Stallman proposes three categories of copyrighted works that are distinguished by their qualitative contribution to society. In which category do typefaces belong?

Is a typeface a kind of witness statement? Existing historic designs are often revived. A typeface designer may develop a typeface with the intention that it witness their thoughts about another design (private communication with professional typeface designer Erik van Blokland, 2007).

Is a typeface a kind of artwork? A typeface designer may create a design based on intrinsic artistic motivations, and a typeface can be appreciated for its aesthetic beauty. Charles Bigelow has said, "typefaces are part of fashion" (Rubinstein, 1988, p.25).

Is a typeface a kind of functional work? Design is distinguished from engineering and art by a focus on users' needs rather than technological implementation or personal expression. A typeface designer may develop a design to meet the needs of users in a specific scenario, such as road signage.

Thus it is difficult to categorise typefaces based on typeface designers' intended contribution to society. However Stallman recommends evaluating a work based on how it is used in society instead, giving users primacy over developers.

While this is objectionable to typeface designers, Fred Smeijers (2003, p.25) echoed the primacy of users over typeface designers in judging a typeface aesthetically: "A type designer cannot escape this responsibility of judgement … In the end, people—the society—either accept it or they don't."

6.3 READERS ARE THE PRIMARY USERS

There are three kinds of typeface users, whose roles overlap: typeface designers, typographers and readers.

Readers are the 'end users' of type, and for them the purpose of a typeface is primarily to enable their reading of a text; Stanley Morison (1951, p.5) said "typography is the efficient means to an essentially utilitarian and only accidentally aesthetic end, for enjoyment of patterns is rarely the reader's chief aim."

That is, the primary use of a typeface is that it represents the characters of a script; readers must be able to read with it. A typeface that did not enable reading would be a paradox, by definition not a typeface. Reading also involves non-lexical activity, such as parsing the visual hierarchy of a text and distinguishing its parts (Unger, 2006).

Readers also have secondary purposes for type, inferring emotional values visually. This aspect of a typeface is akin to artwork and entertainment, and happens somewhat subliminally. For example, readers recognise identity through type, distinguishing company brands. If a typeface represents the opinion of a typeface designer on

another design or was created as art, those may be visible aspects for some readers but in such cases those aspects are tertiary.

6.4 TEXT AND DISPLAY FACES

These two kinds of purposes are reflected in typeface classification systems that distinguish between 'display' and 'text' typefaces (Dixon, 2002). Text typefaces are used to set paragraphs of text with complex lexical structures. Display typefaces are used for short amounts of text with simple lexical structures. For short texts such as advertisements, the secondary aspects of a typeface become primary for readers.

(a) Darkgarden (b) Palatino

Figure 5: Comparison of display and text typefaces.

Stallman has suggested that this could form the basis of a compromise between the free culture movement and the traditionally proprietary typeface design culture; text types must be considered functional since they are primarily about reading, but display types may legitimately be considered non-functional if the emotion conveyed in their visual forms is primary and their readability secondary (personal communication, 2007).

However Stallman is not a specialist in this field, and Smeijers (2003, p.23) has said that "often now the line between artistic practice and design is difficult to draw." Typeface classification expert Catherine Dixon has also questioned the distinction:

> Distinctions between text and display are now increasingly irrelevant, with the greater subtlety that has been introduced into sans serifs and slab serif designs leading to a wider application of such types for text purposes. (Dixon, 2002)

If no clear distinction can be made between the two, Stallman says that since the functional aspect of a typeface is inherent, all typefaces should be considered functional. Therefore all typefaces ought to be free (personal communication, 2008).

6.5 OTHER USERS OF TYPEFACES

However, even if a typeface is in the public domain, readers cannot directly exercise that freedom because printed type is a kind of physical object that cannot be modified. Instead typographers act on behalf

of readers to select and adjust type in anticipation of readers' needs and in response to their commentary.

In turn, typeface designers act on behalf of typographers to develop typefaces in anticipation and in response to typographers. Therefore the free status of typefaces is an indirect concern of readers, but a direct concern of typographers and typeface designers.

All typesetting technologies allow typographers to adjust some aspects of type, such as increasing the inter-letter spacing, but physical limits gave typeface designers full control of typefaces.

With the introduction of photo-typesetting in the 1970s, modifying glyph shapes with coarse optical distortions became possible, such as condensing them horizontally. But physical limits still blocked typographers from easily making fine changes to a typeface.

This changed when desktop publishing arrived in 1985 with the combination of the Apple Macintosh microcomputer, Apple LaserWriter printer, Adobe PostScript page description system, and Aldus PageMaker typesetting program (Kinross, 2004, p.169). Digital type removed all physical limitations so that all typographers could potentially take on the role of typeface designers.

Desktop publishing also blurred the division between authors and typographers, since all computer users with access to laser printers and print shops became de facto typographers. Thus since the 1980s technological advances have brought the issue of freedom in typefaces to the general public, not as readers but as de facto typographers.

With the shift from print to screen-based reading, it is possible for readers to become their own typographers and adjust the typographic layouts—and even the typefaces—they read with. The 'Cascading Style Sheets' (CSS) technology used to specify the design of web pages explicitly rejected that "the author ultimately had to be in charge of deciding how documents were presented ... The user, whose eyes and ears ultimately have to decode the presentation, should be given the last word" (Lie and Bos, 1999).[32]

For these reasons, typeface designs ought to be free as part of a free culture in a free society. The distinction between typefaces and fonts can be seen as a theoretical one; for practical purposes they are the same now that digital typography has eclipsed all other technologies in the printing industry.

32 The issue of 'web fonts' is very much a contemporary development, and as such is outside the scope of this dissertation.

7 SHOULD FONT SOFTWARE BE FREE?

7.1 FONTS AS PROGRAMS

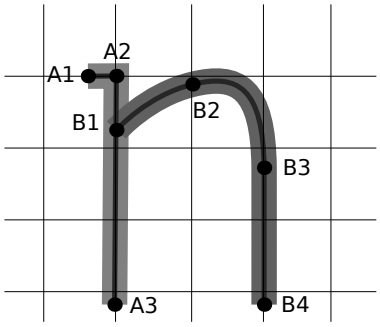
Fonts are generally accepted as a kind of software; but 'software' typically refers to programs, and fonts are not obviously programs, but more akin to data files like illustrations, documents or music files.

Typefaces can be specified digitally as either data, or as programs, or as both. The extreme cases are straightforward.

A program can describe the way a simple glyph is drawn from point to point with a pen in a predefined coded *language*. This is the basis of the METAFONT program that Knuth developed as part of the TEX typesetting system (figure 6a). These symbolic instructions are 'intelligent,' in that they describe *how* to draw the glyph shape, instead of describing *what* the glyph shape is. This means producing a range of variants of a typeface design, a 'typeface family,' can be done in a systematic and convenient way.

```
 1 (glyph "n"
 2  (point A1 ( 0.6, 3.0))
 3  (point A2 ( 1.0, 3.0))
 4  (point A3 ( 1.0,-0.2))
 5  (point B1 ( 1.0, 2.2))
 6  (point B2 ( 2.0, 2.9))
 7  (point B3 ( 3.0, 2.8))
 8  (point B4 ( 3.0,-0.2))
 9  (pickup square-pen)
10  (pen-down A1)
11  (pen-stroke A2 A3)
12  (pen-up B1)
13  (pen-stroke B2 B3 B4)
14  (label points)
15 )
```

(a) Sourcecode



(b) Output

Figure 6: A program describing a glyph and its output.

7.2 FONTS AS DATA

The simplest way of describing a glyph shape is with a table of numeric 'bitmap'[33] data in a predefined *format* (figure 7a) that correspond directly to mosaic dots of an output device—either high reso-

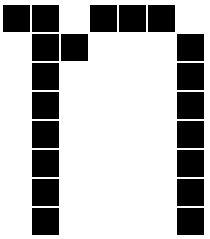
33 'Bitmap' literally means a map of bits; bits are binary digits; 'pixel' is a truncation of 'pixel element' and expands the idea with detailed colour information for each element to describe photographs.

lution printers with 300 dots per inch (DPI), or screens with less than 100 DPI (figure 7b).

In order to be rendered visible, programmatic descriptions of shapes are put through a 'rasterising process' that convert them into bitmap descriptions of shapes. In the early period of digital typography this was a slow process, so bitmap fonts were developed directly as the basis of the earliest 'visual display unit' (VDU) computer screen interfaces (Karow, 1987, p.71).

```
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 1 1 0 1 1 1 0 0 0 0 0 0
0 0 0 0 1 1 0 0 0 1 0 0 0 0 0
0 0 0 0 1 0 0 0 0 1 0 0 0 0 0
0 0 0 0 1 0 0 0 0 1 0 0 0 0 0
0 0 0 0 1 0 0 0 0 1 0 0 0 0 0
0 0 0 0 1 0 0 0 0 1 0 0 0 0 0
0 0 0 0 1 0 0 0 0 1 0 0 0 0 0
0 0 0 0 1 0 0 0 0 1 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

(a) Bitmap data



(b) Bitmap rendering

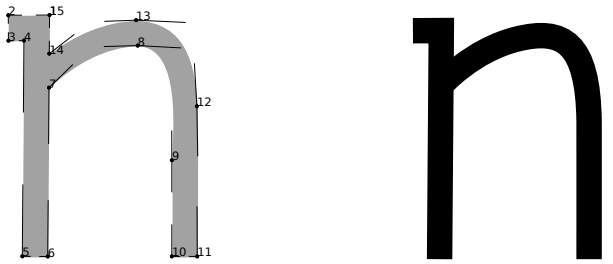
Figure 7: Data describing a glyph and its output.

Vector graphics are an intermediate way of representing a glyph, but whether they are programs or data can seem ambiguous. The program in figure 6a describes the skeletal path of a pen, which the nib shape fleshes out as it passes along that path (figure 7b).

While this is ideally suited for describing type forms that are strongly calligraphic, an abstract lexical program has an indirect connection to the concrete graphical shapes it outputs. This means it can be hard to create shapes as intended, especially less calligraphic ones (Southall, 1985, p.31).

Instead, the path of the outline can be described directly, which is much more simple conceptually and technically. This loses the 'intelligence' of the program in figure 6a, because it uses a pen program to describe only *what* the shape is, not *how* it is drawn. Yet such simple drawing programs are advantageous because direct control of the shape can happen through interactive GUIs where font developers set the points along the path in an entirely visual process (figure 8a).

Large typeface families can be developed relatively conveniently with interpolation techniques. Since users interact with vector graphics in these ways without seeing the programmatic representation of the outlines that underlies their interactive representation on screen, they appear to be data instead of programs. Indeed, they are referred to as being in *formats* instead of *languages.* But technically, they are still programs that describe shapes.



(a) Source (b) Output

Figure 8: A vector program describing a glyph outline, and its output.

7.3 INVISIBLE ASPECTS

A typeface design is not only the black shapes of letters though, and the inter-letter spacing is intimately connected to the letter shapes because "a free standing letter on a small rectangle is a rarity ... maintaining the equilibrium in the white shapes makes all the difference" (Noordzij, 2005, p.14). 'Metrics' are the glyph widths or 'bounding boxes' that form general inter-glyph spacing values, and 'kerns' are their exceptions for specific glyph combinations. These values are simply numerical data.

A font places these shapes and spacings in a technological context. During the rasterising process of display, the typeface may not fit the bitmap grid of an output device crisply.

The Adobe PostScript 'Type 1' font format introduced 'hinting instructions' which were simple because they were intended for laser printers like the 1985 Apple LaserWriter (Haralambous, 2007, p.507). Their simplicity means they are as amenable to being developed visually and without appearing as programs, just as vector outlines can seen as data.

But it also means they are unsuitable for instructing coarse grained computer screens. A complex hinting system based on a full 'Turing complete' programming language (Haralambous, 2007, p.518) was the key patented innovation of the Apple–Microsoft 'TrueType' font format released in 1991 (Kinross, 2004, p.170).

This means TrueType hints can have unintended effects—the 'bugs' inherent in all programs—but when implemented correctly do improve legibility (Sheedy et al., 2008). This is especially important for type at small sizes on low resolution cathode ray tube displays (CRTs).

However as those screens have been replaced by liquid crystal displays (LCDs). These have increased real resolutions of computer displays slightly, but 'sub pixel rendering' techniques have made a dramatic improvement in the effective resolution of such screens through software.

The different approaches to this in Apple and Microsoft's rendering systems has been controversial: Microsoft ClearType is "crisp" but slightly distorts the glyph shapes, while Apple Mac OS X auto-hinting rendering ignores hinting[34] and does not distort glyph shapes, but is "blurry" (Spolsky, 2007). The free rendering software 'Freetype' implements both approaches, although the hinting functionality is only legally used in countries where Apple's patent is not valid (Haralambous, 2007, p.546).

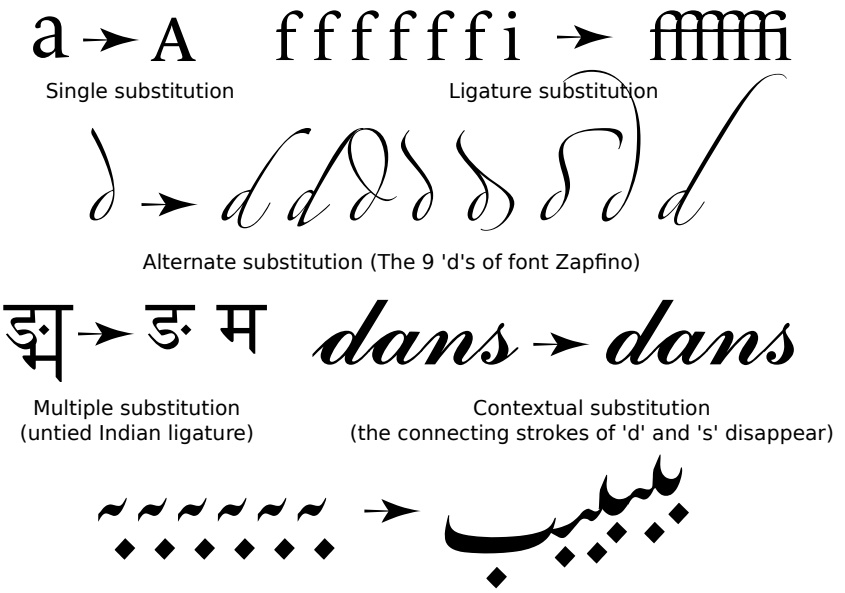


Figure 9: OpenType glyph substitutions, reproduced from Haralambous (2007, p.551).

Contemporary fonts also include additional logic to describe the specific behavior of a writing system for a typeface. This can involve altering glyph positions or substituting glyphs in appropriate character contexts; this is essential for many non-Latin scripts such as Urdu (figure 9).

The most popular 'smart font' format is 'OpenType,' which supports most major languages. It was developed by Microsoft and Adobe and in 2007 became an ISO standard (ISO, 2007) but is partially encumbered by Apple's hinting patents as it can envelop both Type 1 and TrueType fonts' outlines and hints.

OpenType implements complex layout logic through "lookup tables" and despite not being described in a Turing complete programming language, these are programmatic instructions. The more ad-

34 That Apple systems ignore hinting is ironic because Apple is the patent holder for TrueType hinting.

vanced SIL Graphite font format uses Graphite Description Language, "a rule-based programming language" (Correll, 2003).

Although fonts can appear like data both in their parts and overall, they are in fact an unusual kind of program. To the extent a font can be seen as data, this data generates a typeface for reading, itself a functional work. Therefore fonts ought to be free as part of a free culture in a free society.

8 LEGAL STATUS OF FONTS AND TYPEFACES

8.1 TYPEFACES

The US copyright office states that typeface designs are not subject to copyright (USCO, 2008). US courts have explained the reasoning behind this—in their view, the artwork aspect cannot be separated from the functional aspect:

> If the sole intrinsic function of an article is its utility, the fact that the article is unique and attractively shaped will not qualify it as a work of art. However, if the shape of a utilitarian article incorporates features, such as artistic sculpture, carving, or pictorial representation, which can be identified separately and are capable of existing independently as a work of art, such features will be eligible for registration ... It is patent that typeface is an industrial design in which the design cannot exist independently and separately as a work of art.
> (The US court of appeals for the forth circuit, 1978)

However, in the UK designs, including typeface designs, are subject to copyright. This is for a period of 25 years (OPSI, 1988), much shorter than the copyright term for literary works of 70 years after the death of an author (OPSI, 1995). Perhaps this is in recognition of their functional aspects. But it is an anomaly and most legal systems exclude typeface designs from their copyright bargains (Stack, 2008).

Instead variants of the patent system are used, requiring registration and with a much shorter term than artistic copyrights. Copyrights restrict expressions of ideas and not ideas themselves, so that similar but independently developed works that are not exact of derived copies cannot be restricted by copyright holders. These are very similar to copyrights because they are granted automatically and can not be used to restrict independently created designs.

A 'design patent' in the USA lasts for 14 years (USPTO, 2005) and a 'registered community design right' in the EU lasts for 5 years but can be renewed for a maximum term of 25 years (EP, 1998). Additionally the EU grants designers 'unregistered community design rights' for 3 years.

Thus all typefaces older than 25 years are free because they are in the public domain worldwide.

8.2 FONTS

Since typefaces are not subject to copyright in the USA, and design patent registrations are "relatively rare because of the cost and effort involved" (Gaultney, 2003), the copyright status of fonts has been hotly contested there.

Referring to bitmap fonts in 1988, the US Copyright Office said that "A typeface as such is not registrable ... data that merely represents an electronic depiction of a particular typeface or individual letterform is also not registrable" (Walsh, 1996).

In 1998 this changed when United States District Judge Ronald Whyte ruled that vector outline data representations of typeface designs are subject to copyright because they are programs, and programs are subject to copyright as literal expressions. He recognised that while the vector point data is separate from the drawing program, it is also separate from the non-copyright typeface design and the placement of the points involves "some creativity" and is therefore subject to copyright (Whyte, 1998).

Typefaces are discrete from their implementations as software, and like all software fonts are subject to copyright as a kind of literary work for a term of the life of the author plus 70 years.

Part C

THE FREE FONT MOVEMENT

9 HOW FONTS ARE MADE FREE

9.1 THE FOUR FREEDOMS

Together the FSF free software definition and Debian free software guidelines clearly define what freedom means for regular programs, while the definition of free cultural works is similar but phrased more broadly (Free Software Foundation, 2008a; SPI, 2004; Hill, Möller et al., 2006). What does freedom mean for fonts?

Use: Fonts should be free for use in any purpose, in private or in public, by any party, in any field of endeavour. Restrictions on commercial or political or religious use, on how many devices a party can use a font, or on what formats a font can be converted to for use in unforeseen typesetting systems are not acceptable.

Study and private modification: Fonts should be privately modifiable, in any way. This requires users to be able to study them unhindered, so fonts should be available to their users in complete 'source code' form. Complete font source code includes and is not limited to: Glyph outlines; 'master' glyph outlines interpolated to generate outlines; skeletal paths used to design outlines; guidelines and guideline shapes; and features such as hinting and layout instructions. Proprietary, incomplete or completely missing source forms are problematic, but acceptable.

Redistribution: Any party must be able to sell, swap or give the font away at no charge. Requirements for royalties or other fees for such sale are not acceptable. Redistribution must be permitted in all forms; as an independent work, assimilated into another font, as part of a collection of fonts, on in part. Fonts should not place restrictions on other works that are distributed in combination with the font, such as the text of documents typeset with the font.

Redistribution of modifications: Derived fonts must be distributable under the same terms as the licence of the original. Requiring derived fonts to carry a different name or version number from the original, and to retain attribution notices of other contributors, is acceptable.

9.2 FONT SOURCE CODE

What 'source code' means for a font may seem ambiguous since fonts are not lexical programs. However, the version three of the GPL defines source code broadly:

> The "source code" for a work means the preferred form of the work for making modifications to it. "Object code" means any non-source form of a work. The "Corresponding Source" for a work in object code form means all the source code needed

> to generate, install, and (for an executable work) run the object code and to modify the work, including scripts to control those activities ... The Corresponding Source need not include anything that users can regenerate automatically from other parts of the Corresponding Source. The Corresponding Source for a work in source code form is that same work. (Appendix B.5)

This concepts apply directly to fonts: Fonts are developed with font editor programs that store them in 'source code' formats for development, and generate or 'compile' fonts in 'object code' formats for use.

The free software font editor FontForge has a 'spline font database' (SFD) format (Williams, 2008), while the proprietary editor FontLab has VFB format, and both can generate Type 1 'PFB,' TrueType 'TTF' or OpenType 'OTF' files (FontLab, 2006).

The GFDL deals with the concept of source for non-program works, and goes one step further, defining them as 'transparent' and 'opaque' formats: the former is "a machine-readable copy, represented *in a format whose specification is available to the general public,* that is suitable for revising the [work] straightforwardly with ... some widely available drawing editor ... A copy that is not "Transparent" is called "Opaque" ... Opaque formats include proprietary formats that can be read and edited only by proprietary [programs]"

(Free Software Foundation, 2002).

FontLab's VFB format is such an opaque format. This suggests fonts developed with FontLab are precluded from being free. But the differences between object code and source code for fonts are much smaller those for lexical programs[35]: The object code must contains all essential shape spacing and layout information, and all font editors can open and modify font object code because all the major formats are publicly documented.

So a free font developed with a proprietary editor is not a disaster, since the font object code is akin to incomplete source code. Users can still exercise their freedom to use and modify the most important aspects of the font with access only to the object data, unlike programs. Also, it is unlikely but conceivable that the VFB format might eventually be published so that a free software font editor could implement support for it.

However, such fonts do seriously disadvantage users of free editors as they cannot access all aspects of the font in "the preferred form for making modifications to it." The DejaVu project has encountered this problem. It is a community project that develops the Bitstream Vera font, which is free because the GNOME Foundation licenced it from Bitstream under a non-copyleft licence that requires derivatives to be renamed (Gettys, 2003).

35 The 'compilation' process that converts a human-readable source code program into a computer-processable creates object data that is useless to humans and practically unmodifiable.

However, only the font object code was licenced, so the source code for the hints are not available and the project does not modify them (personal communication with DejaVu project administrator Ben Laenen, 2008).

10 FREE FONT LICENCES

Fonts are typically redistributed in part when they are embedded into a digital document such as PDF. This is called 'sub-setting,' and means only the parts of the font needed for the characters in the document are included.

Strong copyleft licences like the GNU GPL make this situation complicated. When a GPL work is combined with another work, the whole must be licenced under the GPL or it cannot be distributed. This means that if GPL font is embedded in a PDF, it requires all other works in the PDF to also be licenced under the GPL—including the text of the document—or the document cannot be distributed.

Weak- and non-copylefts, such as CC-BY-SA or MIT X11 licences, do not cause this problem. The SIL Open Font licence (OFL, Appendix B.6) is a free software licence written specifically for fonts. Drafts were reviewed and refined at various free software and type design conferences (Spalinger and Gaultney, 2007).

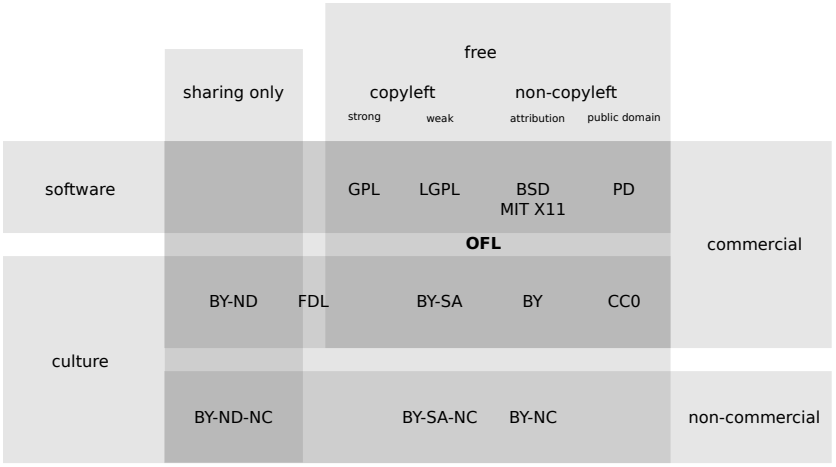


Figure 10: The SIL Open Font licence in the context of other free software and free culture licences.

The OFL accommodates type designers by being very simple, with the only major requirement being that derivatives must be renamed. For example, the 'Gentium' font published under the OFL by one of its authors, Victor Gaultney, can be freely modified and redistributed by anyone, but no one other than Gaultney may call their font 'Gentium.'

This means that like the CC-BY-SA licence it does not require distributors to make source code available on request, like the GPL (Appendix B.3). Neither of these licences or the GPL version 2 mention the issue of transparency, though the GPL requires source code to be made available on request. The other author of the licence, Nicolas Spalinger, explained the reasoning for this:

> One reason was to take into account the fact not all the designers were ready to release everything or would be able to make use of certain types of sources. Making it a cultural best practise to encourage releasing as much useful font sources as possible is the best way forward IMHO. Requiring that would be going too far for many designers.(Spalinger, 2007)

Therefore the OFL, CC-BY-SA, CC-BY or MIT X11 licences are suitable for fonts developed with proprietary programs such as FontLab or FontShop's FontStruct, which has a feature to allow users to apply Creative Commons licences to their FontStruct font object data conveniently (FontShop FSI, 2008).

If a font developer creates a new font with a free editor, they may wish to use copyleft to ensure that they are able to fully edit any derivative versions of the font. Version three of the GPL enables this since requires source code of published versions to "be in a format that is publicly documented (and with an implementation available to the public in source code form)" (Appendix B.5).

Version 3 of the GPL also permits the inclusion of 'additional terms,' similar to the renaming requirement of the OFL. It allows "prohibiting misrepresentation of the origin of that material, or requiring that modified versions of such material be marked in reasonable ways as different from the original version" (Appendix B.5).

The document embedding problem can also be avoided, by making exception to copyleft terms by granting additional permission to distribute the fonts in that way. The licensing section of the GNU website suggests the legal terms to eliminate the problem in this way, known as the 'font exception' (Free Software Foundation, 2008b).

11

BENEFITS OF FREEING FONTS

The primary benefit of freeing type is freedom itself, which is intangible but intrinsically valuable; it contributes to maintaining a free culture in a free society. Yet there are secondary tangible benefits that are derived from people in society exercising the freedom of free fonts.

One kind of change is incremental adjustments to improve the readability of a typeface. Readers can fix the bugs in a glyph's hinting instructions for a font they read on-screen with. The typographer of a periodical print publication may slowly develop optical variants for increased legibility at various printed sizes in response to feedback from readers.

In an unrecorded lecture at the Royal Society of Arts (RSA) in December 2007, Matthew Carter described how the 'Vincent' typeface's development occurred in this way; Newsweek was using this typeface for their headlines and requested additional variations to improve its utility.

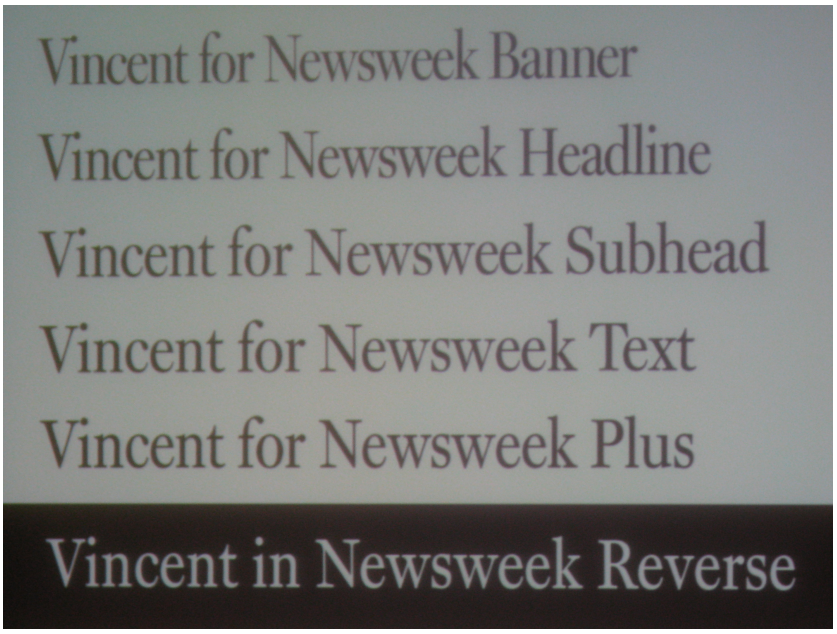


Figure 11: Optical variants of Matthew Carter's 'Vincent' typeface, digital slide projected a lecture at the RSA in December 2007.

Another kind of change is correcting the error of omission in a typeface: Typefaces can omit some characters in a script, and often

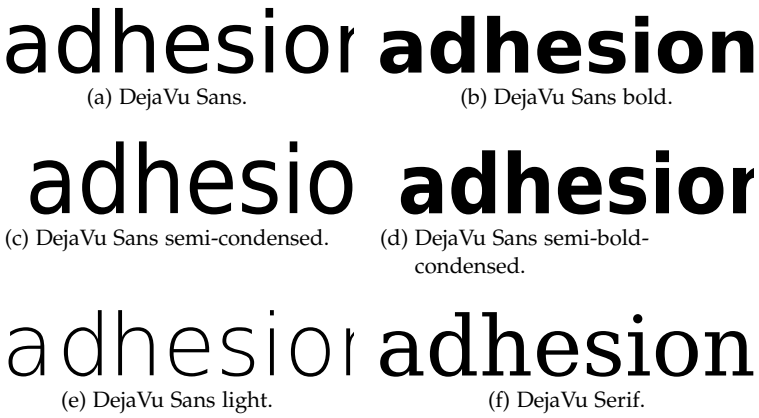
omit characters in closely related scripts. An omission in an encyclopedia or program is a similar kind of error. This is especially the case for non-Latin scripts which include comparatively high numbers of glyphs.

Adobe's policy for the full Cyrillic script is to omit 23 glyphs needed by 12,860,000 people in central Asia (Phinney, 2006). It is unjust that only the American proprietors can correct such errors. This kind of freedom is compelling because it enables 'access to knowledge'—literacy—in those linguistic communities.

Collaborative community development can not happen with proprietary fonts. The 'cathedral' metaphor in Raymond's 'The cathedral and the bazaar' seem an apt metaphor for type design and font software development; they are large undertakings traditionally done monastically in small teams.

Some of the first free fonts had their character range expanded in this way. The company developing GNU GhostScript, Artifex Software, licenced a set of fonts for implementing PostScript Level 2 from URW with the GPL version 2. Valek Filippov in Russia added Cyrillic glyphs, which were later improved by Owen Taylor at Red Hat in the USA. Glyphs for Uzbek and Vietnamese were added by others (Levine, 2005).

'Serial' collaboration contrasts with the 'parallel' collaboration style of the Linux kernel or Wikipedia. The DejaVu project homepage is an example of this, and its homepage states that its "purpose is to provide a wider range of characters while maintaining the original look and feel through the process of collaborative development" and the project lists 41 authors to date (Laenen et al., 2008b,a).



(a) DejaVu Sans. (b) DejaVu Sans bold.

(c) DejaVu Sans semi-condensed. (d) DejaVu Sans semi-bold-condensed.

(e) DejaVu Sans light. (f) DejaVu Serif.

Figure 12: The collaboratively designed DejaVu typeface family.

The project's technical processes involve software engineering practices that are common in the free software programming community but are unusual in type design, such as version control systems.

These are uncommon because the monolithic binary formats of proprietary font editors are not amenable to use in these systems, but free font source code formats are.

There are currently two free font source code formats developed for this purpose. RoboFab first implemented the Unified Font Object (UFO) format for this purpose (van Blokland et al., 2008), and FontForge similarly implements the 'SplineFont Directories' (SFDir) format, which are "sfd files split up into little bits in directories ... to give version control systems a finer granularity and reduce the amount of stuff to download after changes" (Williams, 2008).

The DejaVu project extended Vera with additional weights as well as expanding the range of glyphs, and this suggests collaborative type design can be effective because it is now the user interface font used by most GNU/Linux distributions instead of Vera (Alkalay et al., 2007).

12

THE BUSINESS OF FREEING FONTS

At the 2006 conference of the Association Typographique Internationale in Lisbon, graphic design professor and critic Ellen Lupton presented her view on the free font movement, and published a 'free font manifesto' on her website with a blog (Lupton, 2006a). Lupton presented the movement as non-commercial, and included some example fonts that were freeware rather than free cultural works. However she also identified the impetus for the movement stemming from the need to "serve relatively small or underserved linguistic communities."

Lupton received a negative reaction. In the comments section of her blog Peter Bruhn wrote, "In what way will there be food and shelter for my children" and an anonymous commentator wrote, "You say that type designers have no bread? Then let them eat cake." (Lupton, 2006b).

However, the development of many free fonts has been paid work. Simon Daniels, a program manager in Microsoft's typography group, commented on the blog that "with few exceptions the successful free fonts have had corporate, governmental or other organizational backers that have bankrolled their production" (Daniels, 2006).

For example, UNESCO commissioned Michael Everson to develop the 'Conakry' font for the minority script N'Ko (Everson, 2007) and SIL has employed Victor Gaultney for decades (LISA, 2003), while the GNOME Foundation licenced Vera from Bitstream, and Ascender has been commissioned to develop the 'Liberation' and 'Droid' fonts from Red Hat and Google (Ascender, 2008).

However, there is potential for a free font business using the business model pioneered by Cygnus. A type designer finds a client who wants to commission a new typeface as 'work for hire.' The client is faced with the full cost of the development, but can negotiate a lower price by trading exclusive access to the work.

This is normally so that the type designer can publish the font after some period of exclusivity on proprietary terms to the public. However it could also be so that the type designer can find another client with a similar brief, and both clients can share the costs of development. Professional type designer John Hudson has said that he has worked for clients in this way (personal communication, 2008).

It is also possible for groups of users to collectively raise money to 'bankroll' type design in this way: An initiator estimates the cost of the initial development, $\$\pi$, and estimates the number of people who are will to be patrons, β. The cost per patron is $\$\pi$ divided by β, $\$\Omega$.

The concept of the Pledgebank website is that the initiator can pledge contributing $\$\Omega$ if β other people do (Pledgebank, 2008). When the initiator has publicised the pledgebank enough for β people to

have made a pledge, the money can be collected and use to commission the work. The alternative is holding Ω amounts in escrow, which is administratively costly and risks that β is never reached.

This model is probably not as lucrative as having total power over clients and font users. Stallman has countered such suggestions by saying that "an 'economistic' approach to all these issues [is] a vehicle for unexamined assumptions ... about values, such as that amount of production matters, while freedom and way of life do not" (Stallman, 2006). This business model may generate enough revenue to be sustainable, while maintaining a free way of life.

Such free font businesses do not yet exist, but the free font movement is small. The way that Stallman's GCC was followed by Cygnus, and Torvald's kernel was followed by commercial distributions, suggests a trend of a non-commercial incubation phase, then a cottage industry phase, and then a large corporate commerce phase.

While other business models may be applied to the production of free fonts, perhaps it is impossible to produce them as full time professionals other than under the aegis of a patron. The London-based Demos think-tank published a pamphlet 2004 that described the rise of the 'professional–amateur' or 'pro-am' Leadbeater and Miller (2004).

Computers are omni-competent tools of cultural production and the Internet enables the publishing of any text, audio or video. Both have become extremely cheap in the developed world, so the full process of cultural production is available to anyone there who is not in poverty. The boundary between professionals and amateurs is blurring because both use the same authoring and publishing media.

This is transforming consumptive leisure time into productive leisure time; broadcast television is losing its audience to digital leisure activities. Eben Moglen, legal counsel to the FSF explained this in a speech:

> Michael Faraday first noticed what happened when he wrapped a coil of wire around a magnet and spun the magnet. Current flows in such a wire, but we don't ask what the incentive is for the electrons to leave home. We say that the current results from an emergent property of the system, which we call induction. The question we ask is "what's the resistance of the wire?"
>
> So Moglen's Metaphorical Corollary to Faraday's Law says that if you wrap the Internet around every person on the planet and spin the planet, software flows in the network. It's an emergent property of connected human minds that they create things for one another's pleasure and to conquer their uneasy sense of being too alone. The only question to ask is, what's the resistance of the network?(Moglen, 1999)

If people create cultural artifacts that are valuable, they may find opportunities to exchange that value for money. The popular Creative Commons non-commercial licences are therefore problematic; they risk blocking the development from a non-commercial incubation phase to a cottage industries and beyond.

13 FUTURE DEVELOPMENTS

GNU/Linux distributions include hundreds of fonts (Debian Font task force, 2008; Red Hat, 2008) whose developers have freely licenced the copyrights inherent in the font software. The GPL version 3 is the strongest copyleft licence available for fonts, and it is essential to include the 'font exception' additional permission for document embedding. However, best practices for provisions to require renaming of GPL derivatives have not yet been established.

In addition to the copyright of a font being freely licenced, the typeface it implements much be in public domain or freely licenced too. To make a typeface design freely available in the USA, the designer has to simply not apply for a design patent. However in the EU unregistered design rights are automatically granted for a period of 3 years, and these rights must be disclaimed. There has been no precedent for this in the free font community, though.

Also, free fonts must avoid names that infringe trademarks. It is possible to use the same first two characters for a similar typeface design, so a revival of 'Helvetica' called 'Helopen' would risk trademark infringement while 'Hernan' would not. An exception to this is that people's names and surnames can not be trademarks, so while 'Gill' 'Stone' 'Bell' 'Cooper' 'Zapf' and 'Warnock' are used as names for proprietary fonts, they are not valid trademarks (Stack, 2008).

A methodology or even technology for checking free fonts and type designs to avoid infringing design patents, design rights or trademarks ought to be established.

When people see type that they feel could be improved, if it is in the public domain they are free to do so. With the development of free software font editors, everyone has access to the necessary tools. Now the obstacle is that the knowledge of how to develop and refine type is not freely available.

There is also no central repository from which to easily feed a free font into the various free culture distribution channels, such as each of the popular GNU/Linux distributions. The closest projects to this so far are the 'Open Font Library' and the 'Comprehensive TEX Archive Network' websites (TUG, 2008; Phillips and Prokoudine, 2008). But neither site provides visitors a means of browsing and download free fonts, akin to Bitstream's MyFonts website (Bitstream, 2008). Such a website might also become a central place for free software fonts to be linked from using the upcoming CSS3 web font linking technology, already available in free software browsers like Midori and Apple's Safari.

14 CONCLUSION

Today there are comparatively few free software fonts; the proprietary font development community has produced tens of thousands of typefaces[36] For the free font movement to produce as many, it must engage both the long tail of amateurs that the free software movement enables and for-profit type design professionals.

While today's professionals use proprietary business models, the biggest problem facing the new type designers is obscurity. Treating customers as friends rather than thieves and type design as a service instead of a product may prove an effective way for newcomers to enter the market while reinforcing a free society in the age of computer networks.

> The phrase 'democratization of typography' has become common, referring to the wide availability of the tools of production for type and typographic design. One may take this with some scepticism: after all, for the majority, the generation and production of these tools is still largely in the hands of a few corporations—thought the [free software] movement may provide an alternative. ... The watchwords remain: doubt, critique, reason, hope."
>
> — Robin Kinross (2004, p.182, the final page.)

36 Today Bitstream is one of the largest vendors of proprietary font software, selling 18,018 font families on its website Bitstream (2008).

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Part D

APPENDIX

A EMAILS

This chapter of the appendix comprises copies of emails recieved while undertaking research and confirming details heard in conversation.

A.1 JIM BLANDY ON DEBIAN AND HURD

Jim Blandy has spent his entire career working at major free software companies such as Red Hat, CodeSourcery and Mozilla, and has contributed to famous free software projects such as Project GNU's Compiler Collection (GCC) and debugger (GDB), Subversion and Firefox. His homepage is at `http://www.red-bean.com/~jimb/`

```
Date: Thu, 28 Jun 2007 10:42:50 -0700
From: Jim Blandy <jimb@red-bean.com>
To: Dave Crossland <dave@lab6.com>
Subject: Re: HURD Development & History of the FSF

On 6/23/07, Dave Crossland <dave@lab6.com> wrote:
> I'm researching the history of the FSF, and I see you were
> (and are! :-) quite involved in development of the GNU system.

Yeah, I've pretty much made a career out of it. :)

> Do you know why the FSF has never shipped a bootable OS?

Well, first, let's clarify the distinction between Project GNU and the
Free Software Foundation.  Project GNU is the software project, which
anyone can participate in.  The FSF is a fundraising organization that
happens to sponsor some programmers working on Project GNU.  So the
question is more, "Why hasn't Project GNU ever shipped a bootable OS?"
(This distinction doesn't really matter, but since you said you were
casually researching the history, I thought you might like to know
this stuff too.)

The answer is that Project GNU chose Debian as its official
distribution, and let Debian ship a Hurd-based GNU system.  I believe
Debian does this.  So the premise of your question --- that GNU/Hurd
has never shipped --- isn't true.  Or, to answer it exactly as posed,
"It's not Project GNU's job to ship it; we delegated to Debian."

> (Was it waiting for HURD to become usable? Why not use Linux like it
> uses X and TeX?)

People do use the HURD, but mostly out of eccentricity or curiousity.
```

If you ask Stallman why Project GNU hasn't endorsed Linux as its official kernel, I think he'll say that "The HURD has technical advantages." I don't know if that's still his line, but it was a few years ago.

The HURD does have technical advantages over Linux; they're just not the technical advantages that people actually care about. :) In the HURD, an ordinary user, with no special privileges, can implement their own filesystem or terminal drivers, without disrupting other users of the system. So you can have a 'tar' filesystem, that simply makes the contents of a tar file appear as a read-only tree of files. You don't need the system administrator's permission to run it; it has no security implications. (Getting that to work that way is quite a trick.) You could have bash-style history and line editing as part of the ordinary tty interface, so that you don't have to build it into every shell and interactive program you want to use.

But nobody actually cares, for two reasons.

The first is political, or historical: back in the days where you had a VAX or some other big shared computer, filesystems and terminal drivers were basically impossible for ordinary people to experiment with. You had to have a whole machine reserved for your own use, which was out of reach for most people, especially if they just wanted to try something. In this context, the kind of flexibility the HURD offers is a real issue of freedom: it opens up new areas for experimentation. (Keep in mind that what's attractive about filesystems isn't so much how to store data on the disk, as that the idea of "here's a hierarchy where the leaves are strings of data" is a cool interface to hack on. So you can play indexing games, version control games, networking games, etc.) But if everyone has their own cheap PC whose kernel they can load modules into at will, then none of this is a really big deal. The freedom came in the form of cheap, powerful hardware, not in the form of software to help you share expensive hardware.

The second reason is technical: the HURD was designed by Thomas Bushnell and Roland McGrath. Both of them, but Thomas especially, are simply way too smart for their own good. They had a boundless supply of clever ideas, and implemented nearly all of them. The result is a system which only very few people can learn to hack on. Linux, by comparison, is rather simple. I think the fact that stack sizes are so limited in the kernel forces the Linux folks to keep call chains small and simple, and the result is that it's actually not that hard to find your way around. Linux has astonishingly complicated constraints on its data structures to get good SMP performance, and there are other hairy areas, but it's obviously something that lots of people are able to write device drivers for.

I hope that helps.

A.2 RAPH LEVIEN ON THE ADVOGATO KNUTH INTERVIEW

Raph Levien maintained important free software programs including 'GhostScript' and parts of the GNOME desktop. He founded 'Advogato,' a community blogging website for hackers that implemented his research on trust metrics. Recently he has developed several free software fonts using his own 'Spiro' tools, notable for implementing a new spline based on the Euler spiral. His homepage is at http://raph.levien.com

Date: Fri, 22 Aug 2008 16:44:35 -0700
From: Raph Levien <raph.levien@gmail.com>
To: Dave Crossland <dave@lab6.com>
Subject: Re: 2 second question: Were you the "Advogato" user on Advogato?

Yup, it's me! I gave permission to Steve Rainwater to use the account after I handed over the reins about 2 years ago, but I think he didn't feel comfortable doing so.

Raph

A.3 BRUCE PERENS ON DEBIAN AND HURD

Bruce Perens was an early contributor to the Debian project and took over leadership of the project from the founder. He co-founded 'Software in the Public Interest' and the 'Open Source Initiative,' and is the primary author of the 'Open Source Definition' and the 'Debian Free Software Guidelines.' Perens started the development of 'busybox,' used in most GNU/Linux distributions today.

Date: Sun, 24 Aug 2008 16:33:50 -0700
From: Bruce Perens <bruce@perens.com>
To: Dave Crossland <dave@lab6.com>
Subject: Re: History question about GNU and Debian

FSF paid Ian Murdock to develop Debian for some time, perhaps about 6 months. Unfortunately, Richard's technical direction was not compatible with Ian's, and Richard - although I admire him tremendously - can be a difficult person to work for.

Debian has indeed made a HURD distribution available. I don't believe this has ever been an official FSF project, because FSF is (reasonably, given FSF's goals) concerned about Debian's inclusion of the "non-free" section in the Debian distribution.

I think it's sufficient that a HURD distribution shipped - it need not have been an "official FSF edition" to realize that goal.

Richard, I'm sure, planned to write the HURD, like Emacs and the compiler, but his fingers burned out with RSI before he could do that. What a tragedy.

Thanks

Bruce

A.4 RICHARD STALLMAN ON COPYRIGHT AND AGREEMENTS TO NOT SHARE

From: Richard M. Stallman <rms@gnu.org>
To: Dave Crossland <dave@lab6.com>
Subject: Re: Copyright Vs Contract To Not Share
Date: Mon, 04 Aug 2008 22:05:19 -0400

If an unjust law forbids sharing, and you disregard it,
you have done nothing wrong. However, making a promise
not to share is wrong even if you do not fulfill it.

One could argue for a boycott of all works that cannot lawfully
be shared, but I think it is not ethically obligatory, and tactically
it is premature. Maybe some day this will be a good tactic
in some area.

B

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```

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```
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under certain conditions; type ‘show c’ for details.
```

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>
> <signature of Ty Coon>, 1 April 1989
> Ty Coon, President of Vice

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>
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Version 2, June 1991

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B.5 GPL 3, 2007

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Version 3, 29 June 2007

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