AALTO UNIVERSITY
School of Science and Technology
Faculty of Information and Natural Sciences
Department of Media Technology

Markku Reunanen

Computer Demos—What Makes Them Tick?

Licentiate Thesis

Helsinki, April 23, 2010

Supervisor: Professor Tapio Takala

AALTO UNIVERSITY ABSTRACT OF LICENTIATE THESIS
School of Science and Technology
Faculty of Information and Natural Sciences
Department of Media Technology

Author
Markku Reunanen

Date
April 23, 2010

Pages
134

Title of thesis
Computer Demos—What Makes Them Tick?

Professorship
Contents Production

Professorship code
T013Z

Supervisor
Professor Tapio Takala

Instructor
-

This licentiate thesis deals with a worldwide community of hobbyists called the demoscene. The activities of the community in question revolve around real-time multimedia demonstrations known as demos. The historical frame of the study spans from the late 1970s, and the advent of affordable home computers, up to 2009. So far little academic research has been conducted on the topic and the number of other publications is almost equally low. The work done by other researchers is discussed and additional connections are made to other related fields of study such as computer history and media research.

The material of the study consists principally of demos, contemporary disk magazines and online sources such as community websites and archives. A general overview of the demoscene and its practices is provided to the reader as a foundation for understanding the more in-depth topics. One chapter is dedicated to the analysis of the artifacts produced by the community and another to the discussion of the computer hardware in relation to the creative aspirations of the community members.

The purpose of the thesis is the documentation of the demoscene and its numerous practices. In the current void of demo-related research the study can serve as a stepping stone for other researchers. Among the most important findings are the highly self-reflective nature of the community, the connections between technology and expression, and the positioning of the underground activities in a wider historical context. A large part of the community and its artifacts still remain uncharted, suggesting several possibilities for further studies.

Keywords
Computer demos, Digital Culture, Home Computers, Multimedia

AALTO-YLIOPISTO LISENSIAATINTUTKIMUKSEN TIIVISTELMÄ Teknillinen korkeakoulu Informaatio- ja luonnontieteiden tiedekunta Mediatekniikan laitos	
Tekijä Markku Reunanen	Päiväys 23.4.2010
	Sivumäärä 134
Työn nimi Computer Demos—What Makes Them Tick? (Tietokonedemot – mikä saa ne hyrräämään?)	
Professuuri Sisällöntuotanto	Koodi T013Z
Työn valvoja Professori Tapio Takala	
Työn ohjaaja -	

Tämä lisensiaatintutkimus käsittelee kansainvälistä harrastajayhteisöä, joka tunnetaan nimellä demoskene. Yhteisön toiminta keskittyy reaaliaikaisten multimediaesitysten eli demojen tekemiseen. Tutkimus kattaa aikakauden, joka alkaa 1970-luvun lopussa edullisten kotitietokoneiden ilmestyessä ja jatkuu näihin päiviin saakka. Toistaiseksi aiheesta on tehty vähän tieteellistä tutkimusta ja muunkin kirjallisuuden määrä on lähes yhtä vähäinen. Muiden tutkijoiden tekemä työ kartoitetaan työn alussa ja tukena käytetään muuta materiaalia mm. tietokonehistorian ja mediatutkimuksen aloilta.

Tutkimuksen materiaali koostuu pääosin demoista, aikakauden levykelehdistä sekä verkkomateriaalista, kuten yhteisön verkkosivuista ja demoarkistoista. Yleinen johdatus aihepiiriin auttaa lukijaa muodostamaan kokonaiskuvan ennen syvällisempiin aiheisiin siirtymistä. Kokonainen luku on omistettu yhteisön tuottamille artefakteille ja toinen luku tietokonelaitteiston suhteelle yhteisön luovaan ilmaisuun.

Tutkimuksen tavoitteena on kuvata demoskeneä ja sen lukuisia käytäntöjä. Vastaavien julkaisujen vähäisyyden vuoksi tässä tehty työ voi toimia pohjana muille aiheesta tehtäville tutkimuksille. Tärkeimpiä tehtyjä havaintoja ovat yhteisön vahva itsereflektointi, teknologian ja ilmaisun väliset yhteydet, sekä alakulttuurin toiminnan sijoittaminen laajempaan historialliseen kontekstiin. Suuri osa yhteisöstä ja sen artefakteista on edelleen kartoittamatonta aluetta, mikä tarjoaa lukuisia mahdollisuuksia jatkotutkimukselle.

Avainsanat
Tietokonedemot, digitaalinen kulttuuri, kotitietokoneet, multimedia

Foreword

The background work for this thesis started back in 2004 as an attempt to collect together all the academic pieces of text dealing with the demoscene. Little by little the hobby project evolved into more serious research, which eventually led to a desire to write something about demos myself. Most of the text was written during the spring of 2009 in Mexico during my half-a-year leave of absence from The Helsinki University of Art and Design.

Being a rather active demoscene member since early 1991 and participating in dozens of productions have had a significant impact on many aspects of my life. As a byproduct of a hobby I had the opportunity to learn valuable skills such as programming and groupwork. Largely because of demos I found the interest to study software science and new media, which eventually have led me to my current venues. Last but not least the friendships originally formed in the scene circles have lasted for years and still do. So, in addition to an academic piece of work, the thesis can be considered a testament to those nineteen years spent as a member of the community we call *the scene*.

The thesis was completely produced using free tools such as LyX, LaTeX and The Gimp. The efforts of the creators of these tools are highly appreciated. To encourage the same culture of sharing the text of the thesis is published under *The Creative Commons Attribution 3.0 License* (see *creativecommons.org*). The screenshots of software remain property of the original artists.

I'd like to dedicate some thank yous to the people who have helped me along the way. Thanks to my busy supervisor Prof. Tassu Takala for his encouragement, and to my former workmate Tommi Ilmonen for helping me to get started in the art of academic writing. A collective thank you to all the people who commented on my work or helped me to find material, especially Antti Silvast, Mikko Heinonen, Petri Lankoski, Daniel Botz, Marko Ohra-aho, Doreen Hartmann and Petri Isomäki. Finally I'd like to thank Delia for her support in the good old non-digital world.

Helsinki, April 23, 2010, Markku Reunanen

Contents

1 Introduction **1**

2 Material and Methods of the Study **3**

2.1 Existing Works . . . 3

2.1.1 Research Publications . . . 4

2.1.2 Other Publications on Demos . . . 5

2.1.3 Related Research . . . 6

2.1.4 Diffusion of Innovations Theory . . . 8

2.2 Contemporary Textual Resources . . . 10

2.2.1 Text files . . . 10

2.2.2 Disk Magazines . . . 11

2.3 Online Resources . . . 12

2.3.1 Community Websites . . . 12

2.3.2 Demo Archives . . . 14

2.3.3 Usenet News . . . 15

2.4 Selected Demos . . . 15

2.5 Secondary Artifacts . . . 16

2.6 Content Analysis . . . 18

3 Demoscene Characteristics **20**

3.1 Historical Frame . . . 21

3.1.1 Microcomputer Revolution . . . 21

3.1.2 Models of Scene History . . . 23

3.2 Demographics . . . 24

3.3 Relationship to other Digital Communities . . . 26

3.3.1 Hackers or Not? . . . 27

3.3.2 New Media Art . . . 28

3.3.3 Computer and Video Games . . . 29

3.4 Handles and Groups . . . 30

3.4.1 Taking a Name . . . 31
3.4.2 Group Dynamics . . . 32
3.5 Competition and Fame . . . 33
3.5.1 Striving for Fame . . . 34
3.5.2 Elite and Lamers . . . 34
3.6 Social Networking . . . 36
3.6.1 Parties . . . 37
3.6.2 Swapping, Trading and Spreading . . . 39
3.6.3 Online Interaction . . . 41
3.6.4 Language . . . 42
3.7 Self-Reflectivity . . . 43

4 Demoscene Artifacts 45
4.1 Demos . . . 46
4.1.1 Megademos and Trackmos . . . 47
4.1.2 Demo narratives . . . 48
4.1.3 Themes . . . 48
4.1.4 Development of Effects . . . 49
4.2 Size-Limited Intros . . . 52
4.2.1 64k Intros . . . 52
4.2.2 4k Intros . . . 54
4.2.3 1k Intros and Beyond . . . 56
4.3 Demo Aesthetics . . . 57
4.3.1 Hardware-Dictated Early Years . . . 58
4.3.2 Appearance of Demo Design . . . 59
4.3.3 Frames of Reference . . . 60
4.4 Visual Artifacts . . . 62
4.4.1 Still Images . . . 62
4.4.2 3D Objects . . . 63
4.4.3 ASCII and ANSI Art . . . 64
4.4.4 Disc Cover Art . . . 65
4.5 Scene Music . . . 66
4.5.1 Chip Music . . . 67
4.5.2 Modules . . . 68
4.5.3 Sample Music . . . 69
4.5.4 Software Sound Synthesis . . . 70
4.6 Disk Magazines . . . 71

4.6.1 Selected Disk Magazines 71
4.6.2 Topics of Interest 76

5 Hardware and Software Platforms 79
5.1 8-Bit Computers 80
5.1.1 Commodore 64 81
5.1.2 Less Popular 8-Bit Computers 83
5.2 32/16-Bit Computers 84
5.2.1 Commodore Amiga 85
5.2.2 Atari ST family 86
5.2.3 Early PC Compatibles 88
5.3 True 32-Bit Computers 90
5.3.1 Amiga 1200 and 4000 90
5.3.2 The Improving PC 92
5.3.3 Other 32-bit Demo Platforms 94
5.3.4 3D Acceleration 95
5.4 Roles of Software 97
5.4.1 Tools 97
5.4.2 Algorithms 99
5.5 Effects of Changing Technology 100
5.5.1 Patterns of Diffusion 100
5.5.2 Digital Heritance of the Scene 102

6 Conclusion 104

References 106

A Demo Content Analysis Form 116

B List of Demos Analyzed 117

C Themes of Disk Magazine Articles 121

Glossary

API Application Programming Interface

Artpack A collection of images and/or music, sometimes containing an interactive viewer

BBS Bulletin Board System, also known as a board. A system offering services such as messaging and file retrieval using a modem.

Blitter A co-processor whose purpose is to assist the main processor in graphics generation by copying image data blocks and filling regions

C-64 Commodore 64

C2p Chunky to planar conversion: the reordering of byte-per-pixel data to separate bit-planes

Charts Ranking lists of demos, programmers, tunes etc.

Chippack A collection of chiptunes

Chiptune A musical style that resembles the sound produced by 8-bit computers. Also refers to the small size of a sound file.

Chunky Graphics data stored so that each pixel corresponds to one or multiple consecutive bytes

Coding Programming

Color clash Bleeding, an unwanted effect on 8-bit computers where colors would be displayed incorrectly due to character block attribute limitations

Compo A competition

Copyparty A party focused on copying the latest productions and illegal software

Crack intro A welcome screen containing messages to other groups, shown at the beginning of cracked programs

Cracking The removal of copy protection from commercial software

Crowdpleaser A production that specifically tries to appeal to the audience at a party

Demo A program showcasing the programming and artistic skills of the author(s)

Demomaker A program that enables one to create demos with little or no programming skills

Disk image A single file containing all the information stored on a medium such as a diskette

Diskmag A disk magazine: an electronic magazine originally published on diskettes. Also known as ”mag” and ”maggy”.

Emulator A program that lets a computer run software originally written for other platforms

Faking May refer to one of the following: cheating in voting, reusing stamps in mailswapping, or programming a demo effect so that it looks more advanced than it actually is.

Fast compo A competition where a production (demo, music or picture) has to be created in limited time from scratch

Flyby A flight across a 3D scene

Fps Frames per second

Fuckings The derogatory opposite of greetings

Gfx Grafix, graphics

Graphician A graphic artist

Greets Greetings

Infofile A text file that describes the content of an archive

Intro A size-limited demo, for example four or sixty-four kilobytes

Invitro Invtro, an invitation demo made for a party or a competition

Joke group A group that creates mostly low-quality tongue-in-cheek productions

Lamer A derogatory term used to describe non-skilled people

Leet Elite, at times written with numbers: ”1337”

Leetspeak A style of writing where words are twisted and letters replaced by numbers and other symbols

Metaballs Polygonal approximation of an implicit surface, spheres melting together when they are close to each other

Mod A module: a piece of music containing both the score and the instruments in the same file. In the context of computer games refers to game modifications.

Musicdisk An interactive collection of tunes

Music sync The synchronization of music and visual effects

Mzx Muzax, musax, music

Newbie A newcomer, other forms like ”newb” or ”noob” also exist

Nuskool New school, modern hardware and style

Object show A demo consisting mainly of 3D objects that are displayed (usually rotated) on-screen

Oldskool Old hardware and software or audiovisual style

Otaku The Japanese counterpart of geek/nerd, an overdevoted hobbyist

Pixeling Drawing an image laboriously at pixel level

Prod A production

Reset demo A hidden demo screen that appears when the user resets the machine in the middle of a demo

Ribbon An effect involving a polygonal stripe or tube

Ripping Using material made by others without permission

Rotozoomer Rotating and zooming an image

Scene The demo community, demoscene

Scroller Text moving across the screen

Shader A user-programmable unit in a graphics processor

Slideshow A demo displaying still images, often with music

Soft synth A software sound synthesizer

Song A tracker music file containing only the notes but no samples

Spreading The publishing process of a production

Sprite A small image moving independently on top of the background

Swapping Interchange of demos, pictures, music and other productions among community members

SysOp BBS system operator

Tracker A program for music composition based on the concept of placing notes on individual vertical tracks

Trackmo A demo that loads its content directly from the diskette tracks. Also used to describe the related continuous style.

Trading Modem-based swapping

Trainer A game modification that provides features such as unlimited lives or ammunition

Trolling Posting of controversial statements to heat up online discussion, also know as ”flamebaiting”

Votedisk A diskette used for voting at a party

Warez Illegal files

Wild compo A competition allowing almost any kind of entries without limits on the platform or size

Wobbler An effect based on deforming a 2D image, typically by sine curves

Writer An effect where text is written on the screen

Chapter 1

Introduction

The demoscene—or simply *the scene*, as it is known by its members—is a worldwide community of hobbyists interested in computer demos. A *demo* in this context can be defined as a short, most often non-interactive program that displays audiovisual content in real-time. The demo community has its roots in the late-1970s home computer revolution that made the technology widely accessible to households and hobbyists for the first time in history. Pirate groups that spread copies of illegal software (mostly games) attached screens known as *crack intros* with their messages to the programs, which ultimately lead to the formation of a different community focusing on the programming of such demonstrations alone (Polgar, 2005, pp.40–61; Saarikoski, 2004, p.192; Tasajärvi et al., 2004, pp.12–15).

The motivation for this study springs from the current lack of existing research on demos and the demoscene. The shortage can be explained in many ways, but the bottom line is that a diverse hobbyist culture has largely remained an unstudied piece of history for over twenty years. Introductions to the phenomenon have appeared in a small number of academic publications and some individual aspects have received further attention (Section 2.1.1), but in general such works are scarce. Outside the academic world the number of publications is somewhat higher (see Section 2.1.2), but the writings often lack either width, depth or reliability.

The research problem can be crystallized into a question: *what are the forms and practices of the community known as the demoscene?* The aim is to document the community and link it to a wider historical scope by utilizing different sources such as community discussions, artifacts and research literature. The time frame of the study starts from the late 1970s with the appearance of the first crack intros and popular microcomputers, and extends to cover the past thirty years. The geographical point of view is Finnish and Nordic, but all effort is taken to impartially discuss works from all the countries where significant activities have taken place. While the demoscene should not be considered a monoculture, its international nature makes the results easier to generalize.

It became evident early on that a study on a community, such as the demoscene, could be placed in numerous contexts. Certainly it is part of the history of computing in general and the domestication of technology, but such an approach alone was not considered satisfactory—the contexts of art or media research would be equally valid. Moreover, the strong social aspect of the community would warrant a youth culture, subculture, or gender study approach as well. Finally, due to the recurring theme of technological change and its interplay with the community, the main context of the study turned out to be the history of home computers and their use.

My personal relationship with the subject deserves some discussion, since it has inevitably affected the approach taken, as well as the analysis. The positive sides of a lengthy involvement with the community are a large amount of first-hand experience on the matters, an understanding of the practices and the language, and existing connections inside the community. Achieving the same level of expertise starting from scratch would require a significant amount of time. However, the very same familiarity also introduces challenges to the study. How to step outside of the community and question one's learned points of view? How to investigate the things you "already know", so that the criteria of credible research are met? How to treat people and artifacts neutrally without the bias of likes and dislikes formed during the years of personal involvement? It is impossible to completely discard one's personality from the process, but the use of established research methods and the focus on the large-scale phenomena instead of details, such as individual persons or their works, help to alleviate the bias.

The source material and the methods used in the analysis are discussed in chapter 2. The chapter starts with a survey of the existing written works, after which the primary sources are presented. Chapter 3 serves as a broad introduction to the scene and its cultural practices, providing a frame of reference for the later chapters. Various artifacts such as demos, music and visual works produced by the scene are discussed in Chapter 4. The following chapter, number 5, walks the reader through hardware generations from the first 8-bit machines to the modern multimedia computers. In addition, the major shifts that have taken place in the software domain are presented. Examples of contemporary demo effects are provided to illustrate the relationship of technology and the creative aspirations. The final chapter provides concluding remarks about the study and some future directions.

Chapter 2

Material and Methods of the Study

Due to the multi-faceted approach of the study, no single primary source was sufficient to provide answers to the research problem. Various materials such as disk magazines, online forums, demos and text files were chosen in order to document different aspects. Each of these primary sources required a specific approach to the analysis, since they differ from each other considerably. The most important method was content analysis, which was applied to the material in different ways, depending on the type of source. Additionally, existing work conducted by other writers was examined in order to reflect on their observations, and to strengthen the theoretical backbone of the study.

2.1 Existing Works

During the five years of collecting demoscene-related written material it soon became evident that it hardly exists. The bibliography page of *Demoscene Research* (Reunanen & Silvast, 2004) contains all the directly related works encountered, excluding occasional newsflashes found in newspapers and magazines. Currently the bibliography contains close to forty printed works such as articles, theses or books. Not all the publications can be considered analytical or research-oriented, which brings the amount of academic works found down to about twenty.

It is an intriguing question why exactly the community has attracted so little public interest. In comparison, a variety of publications is available on other contemporary digital phenomena. To elaborate the situation we should consider the probable, tightly intertwined explanations to this invisibility:

- *Underground nature of the scene*. Partly due to its illegal roots and partly due to its closed youth culture nature, the community has intentionally kept itself away from mainstream visibility.

- *Small market segment*. While several hobbies such as video games and music feed multi-billion dollar industries, the demoscene is hardly a significant market that could be specifically targeted.
- *Low visible effect on society*. Demoscene is not affiliated with negative phenomena (such as violence, vandalism or computer break-ins) that would attract interest. The positive effects do not necessarily differ from those of any computer hobby.
- *Low commercial significance of productions*. The community creates productions for its own uses that typically do not have immediate commercial value.
- *Technological nature of the scene*. A good understanding of computers, programming and digital media is required to analyze the artifacts and the related practices of the community.
- *Geographical location of the scene*. Concentrated mostly in North and Central Europe (see Section 3.2 for further discussion) the demoscene has been out-of-sight of American media researchers as well as away from the roots of computer history.

These generalizations obviously do not come without exceptions. As an example, the underground nature of the scene has been on the decline. A small number of books has been published lately (Polgar, 2005; Tasajärvi et al., 2004; Vigh & Polgar, 2006), demos have appeared in art exhibitions (Digitalcraft, 2002; Tasajärvi, 2003), and there even exists an advocacy group with the name *Demoscene Outreach Group* (Scheib et al., 2002). Likewise, the historical link to software piracy, described by Polgar (2005, pp.40–62) among others, can be taken as a counter-example in the case of the social effect.

2.1.1 Research Publications

The most relevant publications on demos so far have been a few theses, conference papers, and chapters in books dealing with a related topic. The majority of the publications originate from the Nordic Countries, which appears to be a natural consequence of the strong local demo community in relation to the overall size of the population.

Among the earliest scene-related articles published, and therefore among the most referenced, is the demoscene overview *The Hacker Demo Scene and Its Cultural Artifacts* by Borzyskowski (1996). The study took place in 1992–1994, so it already represents the situation fifteen years ago. Notable in the title alone is the recognition of demos as cultural artifacts. The most interesting part of the article is the 21-item list of demo characteristics that provides observations on the total of 743 demos viewed. Borzyskowski presents statistics on the origins of the demos, thus providing material for the analysis on the geographical distribution of the groups of that time. Numerous references to cyberpunk more likely reflect the discourse of the time than the contemporary scene reality.

So far, the most extensive study on computer demos, their aesthetics and development appears to be the unpublished (as of September 2009) doctoral thesis by Botz (2008). With an art/media history approach Botz walks through the different eras of computer demos with the intention of building a big picture of their aesthetic development in relation to the technological and cultural currents of the time. Unfortunately, the themes and claims presented in the thesis are hardly represented here due to the language barrier.

Both Lönnblad (1998) and Roininen (1998) have written a master's thesis on a demo-related topic (available in Finnish only). Lönnblad approaches the scene from the point of view of musicology and discusses the structure of demo music, based on a few examples of the time. Together with her other published article (Lönnblad, 1997), the thesis still remains the only study of demo music in such depth. Roininen's thesis provides an equally rare approach: her focus is on the social dynamics of the scene. Her outsider view to the community is both a benefit and a hindrance: she makes sharp observations on the social dynamics but lacks the technical mindset that would be required to understand the phenomenon completely. Both theses also provide a typical overview of the community.

As part of a gender study oriented doctoral thesis *The Net Is not Enough: Searching for the Female Hacker* Nordli (2003a, pp.71–91) analyzes the Norwegian demo party *The Gathering'99*. In addition to scene-related content, her thesis provides valuable tools for understanding the role of women in the chiefly male-dominated computer hobbyist circles. The same theme also appears in another article by her (Nordli, 2003b). Another relevant doctoral thesis was written by Saarikoski (2004). *Koneen lumo (The Lure of The Machine)*, includes a section on the demoscene. Saarikoski provides an overview of the phenomenon from a Finnish standpoint and connects it to the developments of the time. The general topic of the thesis is the history of the Finnish home computer culture starting from the 1970s, and demos are treated as part of that larger framework. The thesis is a continuation of his earlier licentiate thesis (Saarikoski, 2001b), which contains similar analysis of the demoscene in chapters nine and ten.

The bachelor's thesis by Kurki (2002) provides a comparison between the practices of the demoscene (a boy culture) and the decoscene (a girl culture). The thesis treats both communities as *postmodern tribes* and *imagined communities* that exist only through their manifestations. Another comparison between two youth cultures was written by Faler (2001), who used the graffiti scene as his reference.

2.1.2 Other Publications on Demos

The first book published about the demoscene was *Demoscene: The Art of Real-Time* by Tasajärvi et al. (2004). The book was closely connected to the demo art exhibition held at *Kiasma*, The Finnish Museum of Contemporary Art (Tasajärvi, 2003). The book contains an introduction, articles and an illustrated list of works exhibited at the museum. The most

interesting contribution is the proposed tripartite model of scene history, which will be discussed in more detail in Section 3.1.2. Overall the amount of content is limited and the selection of demos represents only a small fraction of Finnish groups.

So far, the most ambitious demo book project was realized by Tamas Polgar, the author of *Freax: The Brief History of the Demoscene* (Polgar, 2005). The first volume contains an introductory part and a history of the Commodore 64 scene, followed by a history of the Amiga scene. It is evident that the target audience of the book is the scene members themselves, since the text requires a good understanding of related terminology and practices to be understood. Certainly the amount of material is massive, but the content should not be taken as is without criticism: at places factual content and scene rumors are blended heavily to create narratives. Polgar's work is still going on and the next volume, dealing with the IBM PC and alternative platforms, is expected. Between the two volumes the writer participated in another *Freax* book project dealing with the visual art of the scene (Vigh & Polgar, 2006). The other author, David Vigh, had already published an online collection on the same topic at an earlier date (Vigh, 2003). While both art books are visually rich and serve as a cross-section to the styles and themes of a number of scene artists, they struggle with the problem of selecting a balanced set of works that would represent the whole timespan and different genres.

Articles discussing demo-related issues have appeared in a few books [see Carlsson (2008); Inkinen & Salmi (1996); Shatz (1993, 1994)] and numerous newspapers. A typical newspaper article is a short newsflash about a local party, as observed by Saarikoski (2001a) as well. Usually the point of view is that of an outsider, and the article reveals more about the attitudes towards the hobbyists than about the actual people in question. In addition to newspapers, media-related magazines have occasionally covered demos on their pages. Two examples of comprehensive introductions published in magazines are Green (1995) and Saarikoski (2001a). Also the game magazine *Edge* covered PlayStation 3 demos in an article (Edge, 2008). The most active publication in this respect is *SCEEN,* which has already in its first two issues featured several articles describing demo parties, groups and exotic platforms (Barbat, 2005; Cruz, 2005; Scholz, 2007a,b).

2.1.3 Related Research

This section deals with the publications that were used for widening the theoretical framework of this study. Among the most important sources of inspiration and points of comparison were media research, digital art and computer history.

Computer history related studies were a fundamental source when trying to position the demoscene in a larger temporal context. Factual information helped to answer questions such as ”Why did microcomputers appear at homes in the early 1980s?”, and ”Why did Commodore dominate the home computer market?” The doctoral thesis of Saarikoski (2004),

which describes the Finnish computer hobbyists starting from the 1970s, was used in particular for finding out about the early phenomena of the home computer age. The central theme of the thesis is closely related to the research problem as well: Saarikoski focused on the different forms the domestication of computers took in youth culture and mainstream media.

Basic facts concerning technical specifications and release dates of game consoles and home computers were mostly collected from the book *Game.Machines* by Forster (2005), which provides a comprehensive, although brief, overview of popular gadgets, coupled with high-quality illustrations. The *Chronology of Personal Computers*, a detailed timeline collected by Polsson (1995), was another reference used when connecting scene activities to the history of computing. The history of Commodore, arguably the most influential company in the 1980s home computer business, was studied by Bagnall (2005). While the book is written more like a story and appears at times rather opinionated, the amount of insight into the company history alone makes it a valuable source.

The work of Sherry Turkle on the psychology of computer users has certainly influenced this study. Her observations on different types of computer users made in *The Second Self* (Turkle, 1984) sheds light to the intimate relationship between the machine and the user, also apparent in many demoscene-related phenomena. Turkle divides the computer users into two categories: *hard masters* who approach problems on the basis of their technical skills, and *soft masters* who are creatively oriented and use technology as a tool. While the division is not likely to be as clear-cut in practice, the concept could be utilized when studying the creative processes of the demosceners. Turkle's more recent book, *Life on the Screen* (Turkle, 1997), continues the earlier work and focuses on the identities people assume in the Internet age. Quite a lot of material is shared with the former book, and the Internet technologies of the time seem archaic from today's perspective; one could say that the increased focus on technology has made the content age more rapidly. The most useful findings in the latter book are related to the complex interactions between the real and assumed personalities of computer users.

The artistic uses of computers were studied in order to proportionate scene activities with mainstream ones. The earliest history of computer-based art was documented by Franke (1971), a pioneer of the field himself. The crude minimalism dictated by technological limits and the lack of established practices in the works of the 1960s may seem outdated to the contemporary reader, but, on the other hand, there are interesting similarities to size-limited intros (see Section 4.2) that are based on the algorithmic creation of visuals. Modern day media art classics have been discussed by for example Wands (2006) and Tribe & Jana (2007). In practice both books are mainly annotated collections of artworks with photos and screenshots. A more research-oriented approach is available in *Media Art Histories* (Grau, 2007), with articles covering a wide range of topics from historical milestones to philosophical essays on the essence of new media.

The observations of Manovich (2001) on the connections of new and old media can be applied to demo research as well: the narrative structures and visual language found in demos most likely owe a lot to methods originally developed in the context of cinema. As an example, the section on *compositing* (pp.136–160) discusses the layering and combining of different image sources, a technique also used in numerous demos.

Youth culture, subculture and gender studies would be realistic frames of reference for demoscene research. In the scope of this thesis, however, such approaches are largely omitted. So far, the only demoscene-oriented publications conducted in relation to those disciplines appear to be the writings by Nordli (2003a), Kurki (2002) and Roininen (1998). The hacker culture books by Levy (1994) and Thomas (1991) were used for comparison between the Europe-centered demoscene and the hacker culture originating from the United States. The historical content of the two books also provide insight to the very birth of computer use as a hobby and a way of life, also discussed to some extent by Turkle (1984, pp.165–195, 202–207). The closely related cracker culture was documented by Rehn (2004) and Vuorinen (2007). The cracker/warez scene publications provide opportunities for reflection with the characteristics of the demoscene.

2.1.4 Diffusion of Innovations Theory

Diffusion theory, originally formulated by Everett M. Rogers in his 1962 book *Diffusion of Innovations* (Rogers, 2003) is the framework for the analysis of the technological changes that have affected the demoscene throughout the years. The theory provides a wide range of tools for understanding the different phases and mechanisms of innovation adoption, making it a lucrative choice when discussing the effects of new hardware or software on the community. *Innovation* and *diffusion* are defined by Rogers as follows: ”An Innovation is an idea, practice, or object perceived as new by an individual or other unit of adoption” (p.36), and ”Diffusion is the process in which an innovation is communicated through certain channels over time among the members of a social system” (p.5).

Rogers divides the diffusion process into five phases: *knowledge, persuasion, decision, implementation* and *confirmation.* In the first phase the individual first learns about the innovation and its functionality. In the persuasion phase the individual forms an attitude towards the innovation, which leads to the decision phase, where the innovation is either accepted or rejected. In the implementation phase the individual starts to use the innovation. Finally, in the confirmation phase the individual evaluates whether the decision made was correct and may still revert back to the old practice. A related concept is *re-invention*, referring to the unexpected ways of adapting an innovation to a practical situation. (Rogers, 2003, pp.168–218)

The adopters, likewise, are divided into five categories based on the time of adoption: *innovators* (2.5% of all the adopters), *early adopters* (13.5%), *early majority* (34%), *late*

majority (34%) and *laggards* (16%). Each type has its own characteristics based on socioeconomic factors, personality and communication behavior. The innovators are described as venturesome persons who have the most connections outside of the local community, but who may not be held in high regard by the community. The early adopters are the respected opinion leaders of the community and therefore crucial to the adoption of the majority. The first big group, the early majority, has the tendency to adopt, but not hastily and not without the consultation of their peers. The late majority is skeptical about the innovation and adapts because of necessity and/or peer pressure. Another characteristic of the group is the conformance to the community's norms. The last group, the laggards, are the last ones to adopt, the most skeptic, and have their frame of reference in the past. The diffusion process and the positions of the adopter categories is often presented as a bell curve (p.281) or the cumulative S-curve (p.11). (Rogers, 2003, pp.267–299)

Other important concepts of the diffusion theory are *the change agent*, *properties of innovations* and *diffusion networks*. The change agent refers to the external instance that wants to diffuse an innovation to the community. The methods and connections chosen by the change agent are seen as a crucial factor in the success of the process. (pp.365–401) The properties of innovations such as their relative advantage, compatibility with the community practices and complexity are discussed in chapter six of the book. Together with the type of innovation decision, communication channels, social system and change agent's efforts they determine the total rate of adoption (p.222). The concept of a diffusion network comprises a variety of themes ranging from interpersonal links to the homo/heterophily of clusters of people, which all affect the diffusion process to a certain degree (pp.300–364). (Rogers, 2003)

The diffusion theory has also attracted criticism, part of which is presented in the book, together with advice on how to overcome the particular problem (Rogers, 2003, pp.105–130). To avoid the possible pitfalls the criticisms need to be taken into account in this study as well.

1. *Pro-Innovation Bias*. The implication that an innovation should be diffused rapidly and completely, as-is without re-invention.
2. *Individual-Blame Bias*. The tendency of researchers to side with the change agencies and blame the failures on the adopters.
3. *Recall Problem*. The researchers rely on the inaccurate data reported by the respondents of the study.
4. *Issue of Equality*. The omission of the negative effects of an innovation, especially the widening of the socioeconomic gap in the developing nations.

The first two issues are not significant to the study, since they largely follow from the link between the researcher and the body funding the research. No such link exists in this study,

so a neutral point of view can be more easily maintained. The issue of equality is not highly relevant either, since this study is not about economy or developing countries. However, if we consider honor and fame as the scene ”currency”, issue number four appears to be more relevant: does a new innovation favor the already respected and hurt the lowest ranks? The recall problem is clearly the most important in the context of this study: how to ensure that the data is not skewed? Certain factors of the material and methods chosen help alleviate the problem. First of all, the data collected is based on sources such as contemporary texts of the time instead of interviews. It should be noted that the recall problem can affect textual sources as well, especially if they were written years after the actual events. In general, the focus on contemporary sources largely removes human factors such as nostalgia and bad recall, with the downside that it does not allow for valuable personal reflection.

2.2 Contemporary Textual Resources

The self-documenting nature of the demoscene is a great benefit for a researcher trying to find material on the past. Already from the late 1980s, there exists quite a rich variety of textual sources describing contemporary events, artifacts, and other topics that were of interest to the community. This section deals with traditional textual sources such as disk magazines and various types of text files, whereas more modern on-line sources appear in Section 2.3.

2.2.1 Text files

Among the most useful text files are the documents related to demo parties (see 3.6.1 for more discussion on parties). In pre-Internet days, it was a common practice to send out an *invitation* to a party as a text file that was distributed by all possible means to get participants to the event. Typical themes of an invitation were the date, the location, the facilities, the entrance fee, and the competitions of the party. After the party, equally important files were the *compo results*, containing the rankings and respective points of the works that took part in the competitions. These two types of text files are basically informative by nature, whereas the third related type, *party report*, serves a completely different purpose. In party reports we can find first-hand experiences and subjective opinions of the writers.

When demos are distributed by a means or another they are usually accompanied by a short piece of text, an *infofile*, containing at least the name(s) of the author(s) plus contact information. A more condensed form of info files is the *file_id.diz* file, intended for Bulletin Board Systems (BBS) where they were displayed in the file listings. Another category of text files are the *tutorials* that contain help on programming tricks for beginners.

The text files described here are mostly used as a secondary source, for checking the facts. Questions such as ”What was the winning demo of the Motorola Inside party in 2004?” are quickly answered by the respective result file. The only exception to the sporadic use is the use of competition results to gather information about the relative popularities of each demo platform, discussed in Chapter 5.

2.2.2 Disk Magazines

Disk magazines—or *diskmags* for short—are the counterparts of printed magazines in the scene circles. Both share some features such as the division of content into separate articles, and the concept of an issue. These similarities exist due to the heritage from the Gutenberg domain, but there are also numerous properties that are unique to disk magazines. For an example of what the magazines look like see Fig. 2.1. A deeper description of the technical aspects and contents is provided in Section 4.6. The focus here is on the relevance of disk magazines to the study.

So far, diskmags have attracted extremely little attention: even directly demo-related publications fail to mention them. Articles on diskmags have appeared mostly in other diskmags. Claus-Dieter Volko is among the most active writers on the topic, as exemplified by the collection of his articles (Volko, 2009). A historical review of the first years of diskmags was written by Jacobsson (2006), a former editor of *Propaganda* himself. Haavisto (2001) published an informal introduction to diskmags in the Finnish print magazine *Enter*.

Figure 2.1: R.A.W. #6 (1993) table of contents

Disk magazines contain a variety of material ranging from demo/game reviews to programming tricks, and even short stories. What makes them an invaluable source for research is

their contemporary nature: the themes discussed in the articles were fresh and interesting at the time of the writing. The points of view represent the attitudes of the era, and since the target audience was the scene members themselves, the opinions stated were not watered down (actually quite the contrary). Moreover, the contents of the magazines are usually well organized into sections which makes it easier to concentrate on the topics of interest.

In this study diskmags were used for numerous purposes. They served as sources of contemporary thoughts, topics of interest, and trends. To represent the different eras and platforms, five diskmags were chosen: *Sex'n'Crime* (Commodore 64, 1989–1990), *Zine* (Amiga, 1989–1991), *R.A.W.* (Amiga, 1991–1996), *Imphobia* (PC classic, 1992–1996) and *Hugi* (PC modern, 1996–2008). Due to the lack of actual hardware the magazines were viewed using emulators (software that lets a computer run other computers' programs). The analysis continued the earlier work by Reunanen & Silvast (2009) and was conducted using *content analysis* as the main method (see Section 2.6). In the first phase the articles were sorted into categories to get an overall view on the themes of interest and types of articles published. In the second phase, the articles of interest were examined further to reveal reoccurring patterns of the language: what kind of expressions were used to convince the readers and to describe positive or negative issues? The focus was especially on controversial topics such as new hardware and software platforms.

2.3 Online Resources

The rise of the Internet has not gone unnoticed in the demoscene. These days a great deal of demo-related resources is available online at the disposal of the researcher. To examine all the websites available alone would warrant a separate thesis, so only general observations are provided on each type of resource.

2.3.1 Community Websites

Community websites host a variety of different contents: for example demo-related discussion boards, party information, news, reviews, demo archives, articles, group homepages, photos and videos can be found on the web. Demo archives are discussed separately in Section 2.3.2. In the context of the study the most important sources were discussion boards, demo archives and video sites that provide video captures of demos in an easily accessible format.

The most important website examined is the popular *pouet.net*, which hosts a discussion board, news and most importantly a large database of demos and groups. In addition to the discussion board (or "BBS") it is possible to comment on the individual productions and leave a positive/neutral/negative rating. The rating system is a useful meter of the

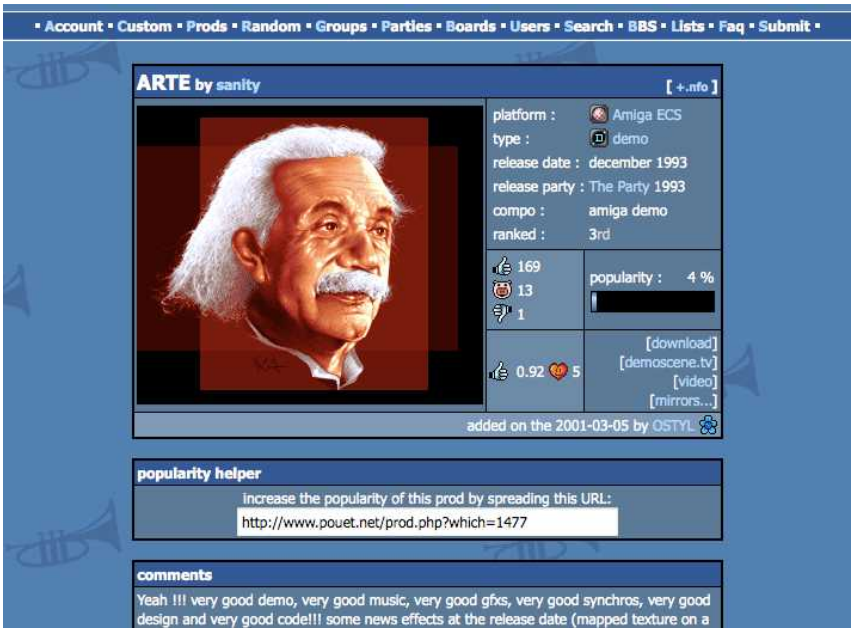

Figure 2.2: The production view of *pouet.net* displaying the details of *Arte* by Sanity.

popularity of a particular demo, also revealing works considered as classics. The demo database is maintained by the global community on a voluntary basis and it contains, as of May 2009, an impressive number of 51,858 productions and 448,108 comments, with more added daily. The details listed for each production in the database are as follows (see Fig. 2.2 for a screenshot):

- Name of the production and its author (usually a group)
- Screenshot
- Platform the production runs on
- Type (e.g. demo, game or diskmag)
- Release date, party, competition and the ranking at the competition
- Date when the production was added and by whom
- Popularity figures such as the amount of positive, neutral and negative ratings
- Download link(s) to the production and its info file
- Comments and individual ratings

Not every detail applies to all the included productions: for example, many old demos were released outside of parties. The screenshots are limited to a size of 400x300 pixels, which somewhat limits their usefulness from a research perspective, since most modern demos run in far higher resolutions. The *pouet.net* system of classification of productions is both

created and validated by the community, which makes it a useful resource when devising similar taxonomies. The taxonomy used in Chapter 4 mostly conforms to the *pouet.net* classification.

Another content-filled community website is *ExoticA* (Lunder, 1996). Especially useful for a researcher are the lists of Amiga and Commodore 64 demogroups that contain member and country information with a description for over two thousand groups. Such material could serve as the basis for different studies on the demographics and the history of the two scenes. On the site, there is also additional content on Amiga games, demo parties and Amiga/C-64 music. Numerous other community websites exist with different foci: for example, a variety of activities take place on the *scene.org* servers (*pouet.net* is also hosted there), maintained by the non-profit *Scene.org* foundation whose aim is to support the community by offering a forum for communication and sharing (Scene.org, 2009). Among the services offered are a demo archive (described in Section 2.3.2), mirrors of other archive sites, IRC (Internet Relay Chat) servers, and web space for demogroups or demo-related sites.

In her doctoral thesis Goryunova (2007, pp.12–20) examined three active artistic websites, such as *runme.org,* and came up with the term *art platform*. According to her an art platform ”is a terminological solution for describing an online platform that enables the crystallization of a cultural phenomenon through the use of of platform’s mechanisms or one, which significantly contributes to such a process.” When comparing demo-related websites to her definition one can instantly notice strong similarities: art platforms are widely available, grass-root, hobbyist sites with an autonomous nature and built-in distinction mechanisms. Community and offline meetings can be compared to demo parties and thus it would seem at first that demo sites could be considered art platforms. Upon closer inspection, however, it becomes apparent that demo sites rather follow already existing practices instead of dynamically forming completely new ones, which ultimately sets them apart from art platforms.

2.3.2 Demo Archives

In the first place, Internet demo archives are a forum for product distribution but, in the case of old demos and platforms, they have also become sites for the preservation of digital heritage. Among the first and best-known projects was the *Hornet* archive, known best in the 1990s sources by its location at that time, *ftp.cdrom.com*. The Hornet effort started already in 1992, and it is currently part of the larger *scene.org* demo archive. In addition to generic demo sites there are numerous platform-specific archives: *The C64 Demo Portal* (*www.c64.ch*), Crack-intro specific *intros.c64.org,* Sinclair Spectrum site *zxdemos.org* and the Amiga oriented *ada.untergrund.net*, to mention just a few.

From a research standpoint, such archives could be used in many ways: to retrieve needed files, to calculate different statistics on the productions, and to browse for possible material

of interest. The majority of the sites mentioned feature a web-based interface that displays textual information about the productions and a screenshot to get an idea of how the item looks like. In the course of this study the archives were simply used for downloading demos and to a lesser extent for finding out specific details about them.

2.3.3 Usenet News

Usenet newsgroups are an international Internet forum for discussion. Among numerous other interest groups, the demoscene has used the newsgroups for active communication. The two newsgroups examined in the study are *alt.sys.amiga.demos* and *comp.sys.ibm.pc.demos*, at times referred to by the acronym *CSIPD*. Both can be viewed in the *Google Groups* archive (Google, 2001), including statistics about the activity during the years. While very active in the 1990s (at times over a thousand messages per month in CSIPD), the groups seemed to cool down around 2002, and during the last few years the discussion has been only sporadic. The downturn can be explained by the growing importance of community websites, providing easy access and a wider variety of content in addition to mere forums.

In the newsgroups, there is such an abundance of topics and messages (tens of thousands in CSIPD alone) that something had to be left out. This study focuses only on the discussions concerning times of change: How did the community react to emerging hardware and software platforms? Messages containing clear opinions for or against the change were selected and analyzed in order to reveal the contemporary attitudes and the rhetoric used when trying to convince other participants (see Section 2.6 and Chapter 5). The time of each discussion in relation to the introduction of the innovations provides some additional insight to the rate and phases of adoption among the community. The majority of the work had already been done for an earlier publication (Reunanen & Silvast, 2009), so little extra effort was required to incorporate the results into the study at hand.

2.4 Selected Demos

The choice of demos for a study like this is a highly delicate matter. *How to represent all the years and platforms fairly?* One possible pitfall is ”history written by the winners”, meaning that the famous party winner productions do not necessarily represent the community as a whole. After all, most of the demos created are not party winners nor made by the narrow elite. To counter these problems the decision was ultimately left to the community itself. Based on the popularity rankings found on *pouet.net* plus various party results and charts, a total of 117 demos and intros were chosen to be analyzed. To alleviate the strong bias towards top entries, a lower-ranking entry for the same platform was chosen for every 3–4 highly regarded productions to represent the ”normal” level of the time, which also allowed for some comparison between the two categories. The aim was to represent the whole

timespan and the most important platforms evenly. The complete list of the works viewed is presented in Appendix B.

Figure 2.3: Demo DVDs: MindCandy 1 (PC), MindCandy 2 (Amiga) and Digital Memories Vol. 1 (Commodore 64)

Because of the lack of real hardware, some compromises had to be made in the viewing process. 8-bit, Amiga, Atari ST and MS-DOS productions were mainly run using emulators. It should be noted that even the access to contemporary computers does not automatically guarantee that the software would work, due to differences in hardware and software (e.g. device drivers). Another workaround was the use of easily viewable demo DVDs (Digital Memories, 2006; MindCandy, 2002, 2006) and video clips of demos, provided by sites such as *capped.tv* and *demoscene.tv*. The DVDs are portrayed in Fig. 2.3.

The research method for the analysis was content analysis (discussed in Section 2.6). The form used in the study can be found in Appendix A. Basic information such as the year, platform and country of origin were collected for statistical use, but the main focus was on the content of the productions. No pre-assumptions were made on the types of parts or effects, so the categories and trends that emerged are purely based on the observations made. The results of the study are presented throughout the thesis, especially in Chapters 4 and 5 in the respective contexts.

2.5 Secondary Artifacts

A number of other artifacts, not discussed above, are created in various scene activities. However, in the scope of this thesis they are considered secondary artifacts that will not be investigated in depth. The purpose is not to downplay their importance, but to maintain the focus on the most important types of digital artifacts. For the sake of completeness, an overview is presented here to provide the reader a wider view on the subject. The list

below is mainly based on the categories of *pouet.net*, with additions found in other sources throughout the research.

Figure 2.4: Party items: badges, wristbands and a t-shirt

- *Computer games*. Despite the traditionally problematic attitudes towards gaming (see Section 3.3.3), major parties these days feature game development competitions among others.
- *Demo tools*: pieces of software made for demo development. Examples of such tools are converters, packers, trackers, demomakers and programming libraries. Sections 4.5.2 and 5.4.1 contain some general discussion about these tools.
- *Group emblems* like stickers, t-shirts and banners, useful for getting visibility at parties.
- *Party-related* artifacts such as badges, wristbands, t-shirts, posters and votedisks (diskettes used for voting at a party). See Fig. 2.4 and Section 3.6.1.
- *Text files* such as BBS ads, voting sheets for charts, and tutorials targeted at beginners.
- *Videos*. Since the emergence of the so-called *wild compos* (competitions with flexible rules) at parties, the demoscene has increasingly produced video clips, with 3D animations and amateur short films being among the most common types. These days demos are also often rendered into video clips to facilitate easy viewing.

A detailed investigation of such plenitude is obviously outside the scope of this study. Many, if not most, of the artifacts mentioned have been equally omitted by other demo researchers

so far. Such omission can be attributed to the intentional focus on demos and the community, and partly to the relatively low visibility of such artifacts.

2.6 Content Analysis

As defined by Krippendorff (2004, p.xviii), "[. . .] content analysts examine data, printed matter, images, or sounds—texts—in order to understand what they mean to people, what they enable or prevent, and what the information conveyed by them does." Traditionally, the method has been used to analyze textual content, such as newspapers, but as the definition suggests, content analysis can also be applied to a wider set of media types. An important property of the method is its indirect nature: phenomena are studied through their manifestations in communication, taking the context of the communication into account. According to Krippendorff (2004, pp.29–30), the fundamental components of content analysis are as follows:

- A body of text, the data that a content analyst has available to begin an analytical effort
- A research question that the analyst seeks to answer by examining the body of text
- A context of the analyst's choice within which to make sense of the body of text
- An analytical construct that operationalizes what the analyst knows about the context
- Inferences that are intended to answer the research question, which constitute the basic accomplishment of the content analysis
- Validating evidence, which is the ultimate justification of the content analysis

A body of text in the context of this study can be real text, such as a selection of diskmagazine articles or newsgroup discussions, or a set of computer demos, as discussed in the previous sections. The *research question* and the *context* are defined in Chapter 1. The *analytical construct* consists of interpretively reading and viewing the research material, bringing in my own knowledge about the practices of the community. Together with the *inferences*, that part of the study is the most dependent on the personal qualities of the researcher. Context analysis, as well as any empirical method, should be repeatable and produce reliable results instead of opinions, and that is why *validating evidence* is required. The use of different sources in this study can be seen as one aspect of validation: for example, newsgroup discussions often deal with the same topics as disk magazines and therefore support or contradict the inferences made. Other points of reference for comparison are the history of home computers at large (Section 3.1 and Chapter 5), and the empirical work of other researchers (as presented in Section 2.1).

In this study about half of the research material is textual. For such material, context analysis is an easily applicable and a relevant method, especially since we're interested in the meanings of the texts to the community. In addition, the nature of content analysis helps to circumvent certain problems that could be more pronounced when using other methods: the effects of bad recall, dealing with large bodies of text, and covering a large time span. For computer demos, however, the suitability can be questioned—is it feasible to apply the method to artifacts? To justify the use, demos must be understood as communication objects of the community. They are not created for the sake of mere experimentation: they are meant to be seen, heard, and reacted to. Similarly to texts, demos contain narratives, written in an audiovisual language.

Chapter 3

Demoscene Characteristics

This chapter serves as a background for comprehending the topics that will be discussed later on. In addition to an overview of the phenomenon, the goal is to reveal some of the practices of the scene, formed over a period of more than twenty years. The artifacts created by the demoscene cannot be sufficiently explained on purely technical grounds, since various practices of the community shape them in multiple ways. An overview of the home computer era and comparisons to other digital communities are provided in order to place the scene into a wider historical frame.

With no knowledge about the controversial and highly competitive practices of the community, an ”outsider” may easily regard demos simply as any tinkering of young computer enthusiasts. The following ironic quote by Grant Smith eloquently illustrates the gap (Leonard, 1994):

> Jonny looks around, confused, his train of thought disrupted. He collects himself, and stares at the teacher with a steady eye. "I want to code demos," he says, his words becoming stronger and more confident as he speaks. "I want to write something that will change people’s perception of reality. I want them to walk away from the computer dazed, unsure of their footing and eyesight. I want to write something that will reach out of the screen and grab them, making heartbeats and breathing slow to almost a halt. I want to write something that, when it is finished, they are reluctant to leave, knowing that nothing they experience that day will be quite as real, as insightful, as good. I want to write demos."
>
> Silence. The class and the teacher stare at Jonny, stunned. It is the teachers turn to be confused. Jonny blushes, feeling that something more is required. "Either that or I want to be a fireman."

Similar divide between young computer hackers and the society can be observed in the frustration of the *Hacker Manifesto* aka. *The Conscience of a Hacker* written by The Mentor (1986). Parents, teachers and society as a whole seem ignorant and condemning in the eyes of an enthusiast devoted to his community. Not willing to play by their artificial rules the hacker finds an escape in the networks where he feels free and empowered:

> Yes, I am a criminal. My crime is that of curiosity. My crime is that of judging people by what they say and think, not what they look like. My crime is that of outsmarting you, something that you will never forgive me for.

The attitudes expressed on demoscene forums such as message boards and disk magazines bear some resemblance to those of the Hacker Manifesto. In general scene members are evaluated on the basis of their actions and merits—not unlike the early hackers of the late 1950s and early 1960s described by Levy (1994). Similar attitudes inside other digital communities were observed by Turkle (1997, pp.177–209, 234–269).

3.1 Historical Frame

According to a commonly held view the first demos appeared in the mid-1980s. Such timing has been proposed by Gruetzmacher (2004), Polgar (2005, p.57) and Saarikoski (2004, p.193). Thus, we are dealing with a timespan of twenty-five years. To include the first widely available home computers, such as *Apple II* (1977), *Commodore PET* (1977) and *TRS-80* (1977) that paved the way, we need to add almost ten years more. In the context of computer history such an amount of time is a considerable span: several generations of hardware and software have appeared, become popular and ultimately disappeared from common use. Likewise, when talking about the demoscene there is quite little in common with the first insecure steps and the current self-conscious community with its well-established practices. Therefore it should be considered at all times that we are not dealing with a uniform ”scene”—a static community that could be frozen and dissected—but a dynamic phenomenon instead.

3.1.1 Microcomputer Revolution

Back in the mid-1970s, following the developments in the field of semiconductor chip design, the very first commercially available 8-bit home computers appeared: *MITS Altair 8800* was released in 1975, *IMSAI 8080* the same year and *Apple I* in 1976 (Polsson, 1995). The first widely available models, such as *Apple II* and *TRS-80* (1977), became popular in the late 1970s. The popular *Atari VCS* also appeared in 1977, followed by other game consoles, such as *Philips G7000* (1978) and *Mattel Intellivision* (1980) (Forster, 2005). By

the early 1980s, other companies had also realized the possibilities of the home computer market, and a great variety of colorful 8-bit computers started to emerge on the market: *Commodore VIC-20* (1981) and *64* (1982), *Sinclair Spectrum* (1982), *MSX* compatibles (1983) from numerous manufacturers, and *Amstrad CPC* (1984), to name a few. For the first time in history, computing was available to the masses.

Gaming was a popular hobby already on the early home computers, and illegal game copying was a common practice. Software developers tried to fight back by using different copy protection schemes, but hobbyists circumvented the protections, which became known as *cracking*. The interview of Mitch/Eagle Soft in *Illegal #30* (1988) reveals that organized cracking groups existed as early as in 1982 on the Commodore machines. The archive known as *Apple II Crack Screens* estimates that the first crack intros date back to 1981 (Scott, 2003). The site includes a screenshot gallery of crack intros, and reveals that initially they were no more than simple text screens displaying the handle of the cracker and the name of the game. Likewise, *pouet.net* contains a few Apple II crack intros from 1981 and 1982.

On the Commodore 64, crack intros became more advanced and contained even simple effects and music (see Fig. 3.1). The C-64 oriented *intros.c64.org* features over 4000 crack intros with screenshots in its extensive collection. Other popular types of game modification were *trainers* that provide extra help such as unlimited lives or ammunition. A plus sign after the game name means that it contains a trainer (Polgar, 2005, p.51).

Figure 3.1: A crack intro by Fairlight (1987)

A commonly held view among demo researchers is that when crack intros started to evolve they became a specialized field on their own and eventually split from the cracker/warez culture to become what we now call the demoscene (Gruetzmacher, 2004; Saarikoski, 2004,

p.192; Tasajärvi et al., 2004, p.15). However, the actual story might be more complicated, since many groups continued the legal and illegal activities in parallel, cracking games and making legal demos at the same time. The same swappers that would distribute illegal software would be involved in demoscene activities as well, as can be seen for example in the contact advertisements of early disk magazines. The separation of the two communities did not happen overnight, and the ties between demosceners and crackers most likely existed at least until the early 1990s.

On the whole, phenomena such as cracking and the demoscene can be seen as examples of unexpected use of home computers. While manufacturers had definitely expected computer games, BASIC programming, and productivity to be among the most popular uses, they could not possibly have anticipated the complex communities that emerged around their machines. Nor were they designing user experiences—they were building commercially viable technological platforms. In the diffusion of innovations theory this phenomenon is called *re-invention,* which is defined as the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation (Rogers, 2003, p.180). The relationship goes both ways: new platforms are used in unexpected ways but the community also needs to adjust its practices to the new devices, as claimed by Lehtonen (2003), who saw the adoption process as a set of trials that need to be passed.

3.1.2 Models of Scene History

In the writings concerning demoscene history, three rather overlapping models have been proposed so far. An obvious first choice would be to proceed chronologically and use time as the main variable. Such a format is apparent in the demo histories written by Polgar (2005) and Tasajärvi et al. (2004, 11–26). There is nothing wrong with such an approach: it is precise and lets one compare the contemporary events between each other. However, a mere timeline of events does not illustrate the larger trends in an easily observable format, as can be seen, for example, in the extensive computer history project by Polsson (1995).

Another model of scene history is presented by Tasajärvi et al. (2004) at the end of the book *Demoscene: The Art of Real-Time.* The timespan is cut into three eras: *Oldskool* (1980–1991), *Middleskool* (1992–1996) and *Nuskool* (1997–). Both oldskool and nuskool are terms that appear in demoscene sources too, oldskool (”old school”) referring to old computers or style and nuskool (”new school”) likewise to the contemporary style. According to Tasajärvi, the oldskool era was the era of Commodore 64 and Amiga 500, characterized by simple effects, small parties, and young sceners. The middleskool era took place on the Amigas and MS-DOS and was marked by design, growing parties and techno, with demosceners moving to institutes of higher education. Finally, the nuskool post-modern era is characterized by PCs with 3D acceleration, huge parties filled with gamers, the Internet, and sceners at work. To criticize the model, one could note that the threefold division is rather

arbitrary and that the model does not age well: the nuskool era would eventually need to be split again, because nuskool always represents the current *status quo*. On the other hand, Tasajärvi makes relevant observations on the parallel events of each era, and the humoristic remarks reveal that the presented model is not to be taken overly seriously either.

While Polgar (2005) deals with individual platforms strictly chronologically, another type of structure is also revealed in the book, namely the hardware-based model. Simply put, first there is the Commodore 64, then the Amiga and then the PC. On one hand, such structure is clearly defined and lets one discuss the complete lifespan of a single platform, but on the other hand, the temporal interactions and overlaps between platforms cannot be revealed easily, and they would cause redundant repetition of the same details. In this thesis, hardware is categorized similarly in Chapter 5, but the discussion of historical trends is not tied to a certain computer only.

Other thematic approaches would be equally realistic, but no such histories have been found. A timeline based on demo effects and styles would provide an interesting view to the developments in artistic expression. Coupled with a technological timeline, such an approach would reveal hidden connections between the two domains (although it can be argued that the two are inseparable to start with). Technology, too, could be treated in more depth than mere hardware specifications: development tools and algorithms constitute another layer, which is at least as important and which has both constrained and facilitated self-expression.

3.2 Demographics

The demoscene has most often been categorized as a dominantly European community of young men. Here, the focus is on the factors of nationality, age and gender, in order to explain some of the reasons behind the demographic distribution of the scene. Additionally, some observations are made to highlight the effects such distribution has had on the community.

According to two scener maps, Frappr (2005) and Andry Joos' *Weltkarte der Demoscene*, as seen in Hartmann (2008), the core of the demoscene is indeed located in Northern and Central Europe. The topic has not been extensively studied by any researcher so far, but the numbers provided by Borzyskowski (1996) also mostly confirm the claim. The most active countries among the 743 Amiga demos that he analyzed were Germany (64), Finland (47), Australia (45), Sweden (38), Norway (38) and Denmark (26). Only the high number or Australian demos is rather surprising, since the country does not appear active on the two maps or in any other source. The number can most likely be attributed to the origin of the paper. The activity of the Nordic countries is observable in Borzyskowski's study as well, especially when considering their relatively small population. The most common countries among the productions listed in Appendix B are Finland and Sweden (19 demos both),

Germany (17), France (9) and The Netherlands (9). Another indicator of the geographical distribution is the location of the biggest past or present demo parties: *Assembly* (Finland), *Breakpoint* (Germany), *Evoke* (Germany), *The Gathering* (Norway), *Mekka & Symposium* (Germany) and *The Party* (Denmark).

Two notable origins of digital culture, Japan and the United States, appear underrepresented in the examples above. Surely both countries have had the economic and technological resources for the development of a demoscene, even more so than their European counterparts, but rather little has ever emerged. Examples of Japanese demoscene are anecdotal at best, and while the US has had some recognized groups such as *Renaissance* and *Hornet,* plus cracker activity (Polgar, 2005, p.48), the amount of activity has traditionally been low. The most believable explanation to this disparity is simply that the hobbyist culture has taken other forms in the two countries. The US hobbyists have a strong frame of reference in their long-standing hacker culture (Levy, 1994; Thomas, 1991), which can be seen as the forefather of the free software movement (Raymond, 2006), whereas Japanese hobbyism has taken the form of *otaku* culture marked by anime, information hoarding and equally deep devotion (Lamarre, 2004; McNicol, 2006). The geographical distance, especially in the pre-Internet era, has hindered communication between the continents, and additionally, technical details have restrained the interchange: for example, the Commodore 64, Atari ST, and Commodore Amiga were all closely tied to the television standards. The European PAL (50 Hz) and the American NTSC (60 Hz) systems could not necessarily run the same software without modifications.

It is a relevant question whether the scene can be treated as a monoculture or not. At first, the practices of the community seem identical regardless of the location: parties, demos and groups are practically the same in all the countries involved. The international nature of the scene is further exemplified by international groups and communication forums. Some nationalism can be observed in demos in the form of flags, and national communities are referred to by their name, such as ”the Finnish scene”, but on the whole nationality does not seem to play a big role, nor is it a source of controversy. Social, economical and political differences between demo countries imply that the origins of the scene are different in each of them, but on the other hand, the established community with its well-defined practices seems to function as an attractor that largely hides national differences.

The age of demosceners has been estimated by several authors, but no conclusive work exists. Roininen (1998, p.82) proposes a range as wide as 14 to 30 years and mentions that the oldest demosceners were born in the mid-1970s (representing the situation of 1998). As an interesting sidenote, she also mentions that the demosceners she interviewed came from middle-class families (p.123). Saarikoski (2004, p.191) suggests a range of 15 to 21 years, but also mentions that ”scene veterans” of over 30 years of age may still be active. Hugi #16 (1999) features the statistics of a study conducted among 224 readers: the biggest age groups were people born in 1980–1981 (33%), 1978–1979 (25%), 1976–1977 (13%)

and 1982-1983 (13%). Only a few respondents were born before 1970 or after 1983. That study, too, represents the situation already ten years ago, but the low number of people in their mid-teens is apparent, hinting at a low number of young newcomers joining the community. The same trend was revealed in a small-scale study of the ages of 26 randomly chosen scene members appearing on the *Assembly'08* party photos of *slengpung.com*: most of them were already in their late 20s or early 30s.

There is a unanimous agreement among the researchers that demoscene members are dominantly male (Kurki, 2002, p.11; Roininen, 1998, p.69; Saarikoski, 2001a). Such a phenomenon is nothing uncommon among other digital communities either: Levy (1994) observed the same among the early hackers, Thomas (1991, p.xvi–xvii) among network hackers, and Håpnes (1996) among Norwegian computer enthusiasts. All those communities also share the characteristics of deep devotion and high regard for technical skill. It would seem that computer enthusiasm is a male domain and has been so from the very early days of computing. But why is it so?

Saarikoski (2004, pp.167–186) discusses the genderedness of the computer hobby from a Finnish point of view and notes that hobbyists reflect the overall trend of the computer industry: from the very early days experts have been men, although women have usually conducted the mechanistic work. In the 1980s families, a home computer was chiefly considered a toy for the boys and the visual imagery of advertisements further strengthened the traditional setting. Nordli (2001) states that, even if the home computer was initially bought for all the children, the active boys would soon displace girls and ultimately end up as the sole users of the machine. She also mentions image reasons as one factor affecting girls' attitudes. Kurki (2002, pp.33–46) treats the scene as a gendered community and claims that its competitive, rational and hierarchical nature in general does not invite female participants. Her study reveals prejudices towards female community members: they easily get categorized as mascots or "nagging bitches", and their capability is often questioned. According to Roininen (1998, p.67–68), the few girls who visited parties at that time were mainly girlfriends of demosceners, not members themselves.

3.3 Relationship to other Digital Communities

Demoscene is only one community among many whose activities revolve around digital technology. Hackers, crackers, otakus, media artists, net gamers, game modders and free software advocates co-habit the digital domain and its networks. Some of them, for example crackers and otakus, share the exclusive underground nature of the scene, while some are geared towards mainstream visibility, like media artists and the free software movement. Here we will briefly look into the features of certain other communities in order to discuss what the demoscene is and what it is not.

3.3.1 Hackers or Not?

It would be straightforward to categorize demosceners as hackers, since they share the same interest in computers and the underground nature. This was the approach taken by, for example, Borzyskowski (1996). Saarikoski (2004, pp.190–210) uses the term *multimedia hackerism*, however, consciously acknowledging the problematic definition of the word. The problem with the word ”hacker” are its multiple meanings that vary greatly depending on the context. In *The Jargon File* (Raymond, 2003) alone, there are eight different definitions for the word.

The origins of computer hackers have been documented by Levy (1994) in his well-known book *Hackers*. Similar histories are presented by Thomas (1991, pp.10–15) in *Hacker Culture,* and Raymond (2006) in his open source oriented *The Cathedral and the Bazaar*. Emerging at the first computer labs of American universities in the early 1960s, the first hackers created a lifestyle composed of technical competence and openness, which was in dire contrast with the exclusive professionalism of IBM and other corporations of the time. Levy describes three hacker types in total: true hackers, hardware hackers, and game hackers. Thomas' book complements the timeline by focusing on network hackers from the 1980s to early 2000s.

Levy (1994, pp.39–49) describes what he calls *the hacker ethic*, meaning the philosophy of the first hacker community. A similar philosophy is still, after forty years, echoed in the contemporary open source movement, as can be easily observed in *The Cathedral and the Bazaar* (Raymond, 2006). The characteristics of hacker ethic according to Levy are:

1. Access to computers—and anything which might teach you something about the way the world works—should be unlimited and total. Always yield to the Hands-On Imperative!
2. All information should be free.
3. Mistrust Authority—Promote decentralization.
4. Hackers should be judged by their hacking, not bogus criteria such as degrees, age, race, or position.
5. You can create art and beauty on a computer.
6. Computers can change your life for the better.

The principles of accessibility, art, meritocracy and positive change are in line with the scene practices, but the rest are not shared as unequivocally. For example, the freedom of information in the form of collaboratively sharing program code is extremely rare. The dominating culture has been one of secrecy: not revealing one's tricks and secrets to others.

To illustrate the rarity, we may consider the list of available demo source codes, published in *Hugi #35* (2008), containing 112 items. Compared to the total amount of demos (see Section 4.1) we get an estimate in the order of magnitude of per mil. Also, the principle of decentralization is partly in contrast with the scene's tendency to follow the commercially dominant hardware and software platforms (further discussed in 5.5.1).

According to Thomas (1991, pp.xiii–xv), in mainstream culture the word ”hacker” is often linked to network criminals. To distance itself from illegal activities the hacker community has started to use another word, *cracker*, to describe the system breakers (Raymond, 2003), whereas in the scene context the word has traditionally referred to copy protection removal, *cracking*. Interestingly, in the cracker study written by Vuorinen (2007), we find explanations to why the scene and the hacker ethics are so distinct in some aspects. Vuorinen describes three software distribution models: the proprietary, the open and the cracker model, and claims that crackers are a product of proprietary software distribution. In contrast to this, the open model springs from a different paradigm, which is why it's inevitably in conflict with the proprietary system. Based on Vuorinen's analysis on crackers, it is easier to understand the demoscene's (with its roots in software piracy) affiliation with the commercial world.

3.3.2 New Media Art

By definition, demos *are* new media art: creative multimedia made with digital tools. However, there exists a gap between the demo community and the different genres of media art. Even a quick glance at media art publications (Grau, 2007; Tribe & Jana, 2007; Wands, 2006) reveals that demos are not part of the same discourse. What are the reasons for such separation, and are the domains drifting towards each other or rather further apart?

One explanation to the situation can be found by inspecting the origins of the communities. While the demoscene is a child of 8-bit home computers and games, and at least originally a youth culture, other genres of media art have their roots in other domains. The technological forefather of the contemporary movements, computer art, established itself little by little in the 1960s and was initially restricted to large companies and educational institutions that could afford the expensive hardware, as documented by Franke (1971). According to Wands (2006, p.184), many digital artforms have their roots in traditional media. Among others, the genres of installation and video art, sculpture and performance all have their counterparts in the field of new media art—existing practices evolved into something new when augmented by digital technology. Probably the closest relatives of the demoscene in this respect are visually-oriented *VJ (Visual Jockey) art*, *game art* (the creative use of game engines), and *algorithmic art* (also known as *software art*).

With so many genres and constant evolution it is difficult to talk about ”new media art” as a single entity. However, for the purpose of comparison with the demoscene some generaliza-

tions need to be made. The first notable difference between demos and other forms of digital art is the limited scope of forms demos can assume: there are strictly defined categories of artifacts, pedantic competition rules and platform restrictions. The audience also has clear expectations concerning the content, acceptable frame rate and the style: what is demo-like and what is not. Another defining characteristic of computer demos in comparison to, for example, net art, game art and digital installations, is that they are hardly ever interactive, not even participative. Demos are meant to be watched, not touched, which connects them conceptually to digital video.

Thematic differences, too, separate computer demos from other forms of media art to some extent. The demo community is markedly non-political (with a few rare exceptions discussed in Section 4.1.3) and mainly focuses on audiovisual show-off instead of activism. In dire contrast with this, a great number of media art works try to convey a message and engage the the audience both emotionally and intellectually [for some examples see Wands (2006, p.26, 56, 57, 68, 106, 180)], which of course is not to say that technologically impressive audiovisual perfection would not be an integral part of other genres.

The persistently underground nature of the demoscene separates it from many forms of digital art discussed above. The exclusive nature of the community tends to keep its artifacts inside the borders, out of sight of the outsiders. There have been some attempts to bring more mainstream visibility to demos during the last few years (see 2.1), which can be interpreted as a growing need to receive recognition outside the community as well. Nevertheless, such activism has been scarce and, based on the frequency of the attempts, the trend does not seem to be on the increase either. While other forms of media art are frequently exhibited at high-profile galleries and museums, or reach a wide audience through the Internet, the demoscene remains both the main producer and consumer of its artifacts.

3.3.3 Computer and Video Games

The history of the demoscene is inseparably connected to computer and video games. Early home computers, often used for playing games, and the related software piracy, as argued above, were the necessary prerequisites for the existence of the demoscene of today. Technological developments driven by the multibillion-dollar game industry have facilitated demoscene activities in the form of increasingly multimedia-capable hardware and content production tools. Naturally, demosceners also play digital games. Despite all of this, the attitudes towards computer and video games have been ambivalent and problematic for a number of years.

Starting from the early 1990s, the demoscene has clearly distanced itself from computer game players. The change is apparent in, for example, disk magazines, which used to contain game reviews and hints until the early nineties. Later on, the number of game-related articles dropped close to zero (see Section 4.6). The change took place in parallel with the

growth of the self-consciousness of the community, and can be explained by the increased need to emphasize the uniqueness of the scene, and thus separate it from other communities. According to a popular attitude, reflected in several diskmags, the sceners were considered as skillful and creative, whereas game enthusiasts could not do anything else than play with their computers. To complete the ambivalence, the amount and quality of games available have been repeatedly used as arguments—both for and against—in the opinionated diskmag articles and Internet discussions about emerging platforms. The following comment by *StyX/HeadcrasH* taken from Hugi #23 (2001) recaps the scene mentality rather well:

> I'm talking about our beloved species of gamers. Well, the hardcore-gamers, those people we usually call more exactly lamers.

A number of demo-related publications mention the connection between the demoscene and game companies (Kauppinen, 2005; Saarikoski, 2004, p.205; Saarikoski & Suominen, 2009; Scheib et al., 2002; Tasajärvi et al., 2004, p.23). In the articles, the scene is sometimes even described as "a pre-school for the game industry". The article about game companies employing demosceners, written by Beck (2008), mentions twelve high-profile game houses, so it would indeed seem that real-time multimedia-oriented programming, pixeling and composing skills required in the demoscene are valuable assets in game development. Saarikoski (2004, p.205) also mentions three game companies (*Digital Illusions*, *Housemarque* and *Remedy*) founded by demosceners, but goes on to say that to most of its members, the scene has been a serious hobby and a way of life, not an investment in a future career. The source material of my study does not reveal such tendencies either, so the connection to the game industry could be better considered as a byproduct instead of a direct motivator.

The complex nature of the attitudes towards gaming is clearly visible in the source material: while game players were criticized harshly on many occasions, game development hardly ever received negative attention. At times there was even notable excitement over the games developed by former scene members—once a member, always a member. Another related factor is that gamers and sceners co-habit the same hobbyist domain, whereas the game industry operates in a very different dimension altogether, and thus will not be considered a competing community.

3.4 Handles and Groups

The vast majority of all demos are created by groups. As an example, almost all the demos viewed for the study were published by a group (Appendix B). On the lowest level, an individual is a member of a small tightly-knit community of the group, and in a wider

scope, a member of a much larger community such as ”the Amiga scene”, ”the PC scene”, and ultimately the combination of all of them, *the scene.*

Most demo-related publications acknowledge the existence and structure of demo groups. However, hardly any of them have tried to go beyond the easily observable surface, or to explain what actually are the meanings and reasons behind such hierarchy. Usually, we only get to read about the division of labor: there are coders, musicians and graphic artists who create demos together. As of now, the most notable works dealing with the identity of the demoscene members are the theses by Kurki (2002) and Roininen (1998). Kurki uses the concept of a *micro community* to describe demo groups, referring to the small, devoted communities that are formed inside the larger *postmodern tribe*, in this case the demoscene. According to Kurki, the members of such exclusive micro communities tend to share the same interests and strongly identify themselves with the community (pp.26–29). Roininen (1998, pp.38–44) emphasizes the organized nature of the scene and the tight group work involved in the demo creation process.

3.4.1 Taking a Name

Demoscene members are best known in the community through their *handles*, also known as *aliases*. Examples of people using their real name in productions have popped up at times during the study, but in general such cases have been scarce. Likewise, groups always have a name. The demoscene inherited its naming conventions from its forefather, the cracker/warez scene. According to Polgar (2005, p.40), crackers used handles to distract law enforcement and hide their real identity. Sex’n’Crime #20 (1990) supports the claim by discussing the reasons why people changed their handles: fear of law enforcement, suspicion of the post office and a tarnished name. Nevertheless, such reasons do not sufficiently explain why the more legally-oriented scene would still retain the practice, hence there must be more to it.

On a practical level handles are frequently represented in relation to the group: for example, *Crust of Appendix*. Another way of expressing the same relation is with a slash like *Crust/Appendix*, still pronounced ”of”. Long group names may be abbreviated to two or three letters for the sake of saving time or space (for example in filenames), so the example handle might end up looking like *Crust/APX* as well. An fundamental property to note here is the strong tie between the individual and the group: the notation itself reveals that a member is ”of” the group, a part of a bigger, clearly defined whole.

Kurki (2002, p.48) observed that handles (or *nicks* as she calls them) are often related to science fiction or fantasy literature and movies, genres that are of interest to young males. The same orientation is apparent in the visual art of the scene as well: especially in the 1990s fantasy was among the most popular themes (see Section 4.4). Another category of handles mentioned by her are the variants based on the real name of the person. The international

nature of the scene is illustrated by the language of the handles, which is mostly English (Roininen, 1998, p.18). The topic has appeared a couple of times in disk magazines: Imphobia issues #8 (1994) and #12 (1996). In the former, Zeb/Zuul Design rather humorously categorizes aliases in the following way: *first names*, *shorts* (like abbreviations), *lamer-aliases* (stupid names), *function-handles* (that describe the person's activity), *gloomy/scary* and *with imagination* (exceptional names). In the latter, Phoenix/Hornet sheds some more light on the concept of handles from a scener's perspective. He seconds Polgar when discussing the origins of handles by mentioning the privacy concerns of early crackers. He also presents arguments for/against the use of handles and, interestingly, commercial reasons are brought up as a possible benefit of using real names: companies are more likely to contact people who go by their real name.

Taking a name serves two major purposes that are not practical but highly personal instead: self-expression and power. A name represents the individual and his identity in the community. Instead of hiding from the police behind an alias, a demoscener brings himself forward and makes a statement, no matter how small, to the community by selecting a handle. The observations of Kurki (2002, p.48) and Roininen (1998, p.90,106) also suggest that the expression of one's identity is a fundamental reason for choosing a nickname.

Similar practices exist in various other contexts (e.g. online communities, the graffiti scene and hacker culture). Faler (2001) compared the demoscene with the graffiti scene and found a number of reminiscent properties: handles and groups were present, but also other practices such as phases of entering the community and the networked nature of the hobbies. Roininen (1998, pp.107–110) used hip-hop culture for her comparison. Handles and groups were present in the hip-hop circles as well. Network hackers, too, use handles and form groups with names, as documented by Thomas (1991, p.58, pp.90–91).

3.4.2 Group Dynamics

The three most visible roles in demo groups, apparent in artifacts such as demos and intros, are the *coder* (programmer), the *musician* and the *graphician* (graphic artist), each representing a certain type of activity needed for creating demos and other artifacts. Each role and its respective duties are well defined, although there is also room for movement. Numerous other roles can be found in source material such as *ExoticA!* (Lunder, 1996), each representing a different task related to the activities of a group: ASCII artists, crackers, designers, editors, leaders, organizers, support/hangaround members, swappers/traders, raytrace artists, suppliers (of software), SysOps (BBS operators), and webmasters. A similar—even if much more limited—taxonomy of duties is apparent practically in all the writings on the topic: Burger et al. (2002), Gruetzmacher (2004), and Roininen (1998, pp.15–17).

Figure 3.2 was compiled using the productions listed in Appendix B in order to approximate the number of people involved in the creation of a demo. It should be noted that

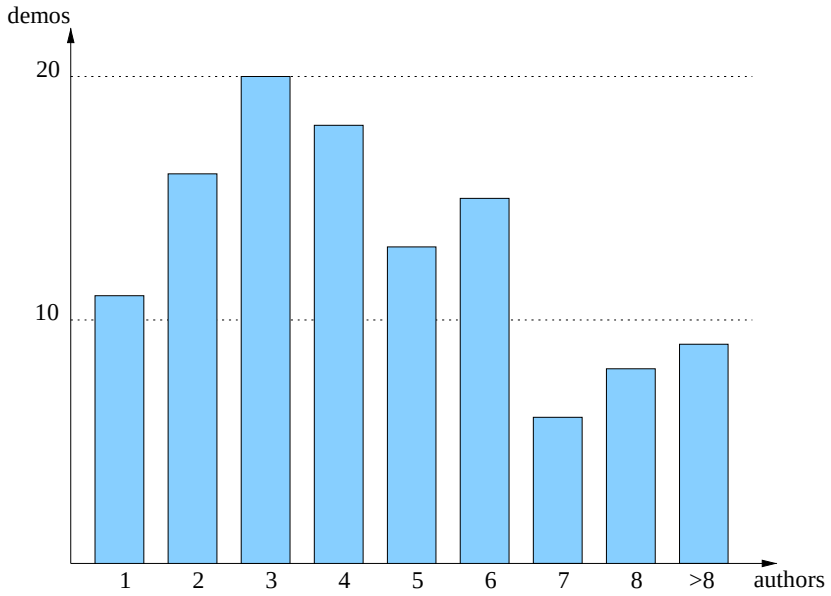

Figure 3.2: Number of authors in demos

the extreme ends are somewhat emphasized by crack intros made by one person only, and large megademos that were collaborations between multiple groups. While groups at their peak can consist of dozens of members, it seems that demos and intros are typically created by only a few authors. Such disparity suggests that in the demoscene, small workgroups are dynamic and productive: they do not require extensive communication or coordination. In the domain of software production a similar effect was observed by Brooks (1975), who claimed in his well-known essay *The Mythical Man-Month* that adding new programmers to a project running late will actually slow down the progress even more, due to the increased amount of communication and the time lost in introducing the project to new participants.

3.5 Competition and Fame

The demoscene is in a constant state of competition, which is exemplified by numerous practices of the community. To get to the top and acquire *fame* one needs to impress, win, and be connected. Kurki (2002) discusses the same phenomenon and compares the scene (a male-dominated culture) with deco swapping (a female-dominated culture) from the standpoint of competition. According to her, both communities are competitive, but in a different way: in the scene competition is made visible and accepted, whereas deco swappers compete under the hood and do not criticize others' works directly.

3.5.1 Striving for Fame

Probably the most visible manifestations of the constant state of competition are the *compos* (competitions) held at parties. The winning productions, typically the best three, receive prizes and, more importantly, visibility inside the community. Winning competitions at big parties is a fundamental way of growing the fame of the individual and the group. Other equally explicit manifestation of competition are the *charts* that used to be an important part of disk magazines. In the very first diskmags (*Sex'n'Crime* as an example) the rankings were decided by the editors, but soon popular vote established itself as the standard. The public wrote down their favorites from different categories on voting sheets, sent in the sheets, and ranking lists were compiled based on the votes. A high position on the charts was both a result and a source of fame: on one hand, popular groups and artists got more votes, and on the other hand, the visibility contributed to their fame.

Fame can be acquired through several means. All sorts of participation in community activities, be it discussion on disk magazines or online forums, attending parties, or swapping productions, increase the visibility of the group. Technical skills are admired, as we have observed already, but the most known and highest-ranking groups have one more thing in common in addition to mere skills: they are well connected. In demos it is common to send greetings (*greets*) to other respected groups that are connected to the authors in some way. It is hardly a surprise that, in the demos observed, the top groups know and greet each other, thus mutually building their prestige in the community. For an example of greetings see Fig. 3.3. In the example, the greetings have almost become a mechanistic tool: the long list of groups is sorted alphabetically, spans multiple pages, and the high-contrast names are displayed for quite a while.

Competition on the whole is a typical feature of male-dominated youth cultures. Similar patterns have been observed in other computer enthusiast communities by Håpnes (1996, p.136), Levy (1994, p.115–118), Thomas (1991, p.xvi), and Turkle (1984, p.210, 231). Another common denominator is that skill is held in high regard. Already the first hackers tried to improve existing code snippets by inventing ingenious programming tricks, rewarded by the approval of the community (Levy, 1994, p.44). Both Kurki (2002, p.43) and Roininen (1998, pp.65–71) name direct competition as a factor in the genderedness of the demoscene.

3.5.2 Elite and Lamers

The social system of the demoscene can be described as a form of *meritocracy*: recognition is distributed based on the achievements of the individual and the group, not evenly. According to Levy (1994, pp.115–118), a similar ranking existed already among the MIT hackers, who divided computer users to winners and losers. Accordingly, the demoscene has two categories that describe the high performers (*elite*, "leet") and the lowest ranks

Figure 3.3: The greetings part of *Eclipse* by Electromotive Force

(*lamer*). Already the disk magazines of the late 1980s, such as *Sex'n'Crime,* featured such wording. An illustrative example of the past exclusive nature of the elite circles was written by Kauppinen (1991). To call somebody a lamer was a serious insult because of all the negative connotations associated with the term. Quoting the editor's reactions from Sex'n'Crime #21 (1990):

> Dear Roy of Dynamics, let me say this from the bottom of my heart: you are lame!

Numerous articles in diskmags have been dedicated to discussions about lameness: *who is lame and what are the characteristics of a lamer?* On the other hand, the essence of elite has not received even nearly as much attention. It can be assumed that "elite" is something that does not require much defining and, additionally, the concept of lamer is more interesting since it clearly represents a lower rank. Nobody would want to be a lamer and therefore it is important to distance oneself from them, by putting them down and defining them as something else than oneself. Some quotes illustrate the efforts the scene members have taken to define a lamer:

> The most typical lamer type is the guy in a group nobody knows because he has no contacts, moreover no coders, musicians, gfx... But this kind of lamers would like to be famous. But he isn't because he can't do anything. (Brainwawe, Zine #02, 1989)
>
> The first is the lamer who rip all, because he can't do something alone. The first is a very dirty race of lamers because they injure the scene. The other is

> a person who use his computer only to play games. (Zorlock, Imphobia #1, 1992)
>
> The people with no interest in the scene and in demos, scene music and graphics whatsoever – the, I write and mean the word honestly, LAMERS. (Curt Cool/Depth, Hugi #19, 2000)

While there seems to be a general consensus that lamers exist and are bad for the scene, the opinions towards newcomers (*newbies*) are more divided. Some sceners, when describing a lamer, actually refer to the characteristics of a newcomer who has not yet learnt the necessary practices and skills. Some argue that the scene should actually support newbies to help them develop themselves and that everybody has been a lamer or newbie at some point before improving their rank. All in all, it is apparent that the lamer/elite division has lost quite a lot of its importance during the years. In early diskmags the words appeared constantly and little by little they became less common. The change can be attributed to at least two factors: firstly the rise of the *friendship* attitude in the early nineties as counteraction against the harsh atmosphere of the scene, and secondly, to the increasing age of the community members (see Section 3.2).

3.6 Social Networking

Even though the social dimension is largely omitted in this study, some aspects need to be discussed due to their fundamental relevance: after all, the demoscene is a social network more than anything else. The sections above have already outlined demographic factors and revealed some facets of the dynamics and hierarchies of the scene. In this section, the focus is on the different communication channels that the scene members use for keeping in touch and discussing topics of interest with others.

The communication channels of the demoscene can be compared to the *diffusion networks* in Rogers' innovation diffusion theory. Such networks are structured, somewhat stable and link individuals by patterned flows of information. A central concept is is the *homophily/heterophily* of the network: the degree of similarity of a pair of individuals in terms of beliefs, education and socioeconomic status. Generalization 8-12 states: "Individuals tend to be linked to others who are close to them in physical distance and who are relatively homophilous in social characteristics". Homophilous communication is likely to be more effective, but on the other hand heterophily is needed to introduce innovations to the system. *Opinion leaders* also play an important role in the system, since their credibility helps to diffuse innovations to the less adventurous adopters. (Rogers, 2003, pp.300–364) Demoscene networks such as swappers' networks, interpersonal connections, and communication forums can all be thought of as layers of a large diffusion network spanning the en-

tire community. In this context, innovations are new effects, programming methods, styles, attitudes or practices that diffuse through the communication channels.

3.6.1 Parties

A party is a meeting place for demosceners and a venue for various activities. Parties have existed in some form throughout the entire history of the scene, although their purpose, form and magnitude have changed significantly during that time. Most researchers who have dealt with the history of demo parties agree that they were preceded by the piracy-oriented *copyparties*, where cracker groups got together to swap software and meet each other (Polgar, 2005, p.60; Saarikoski, 2001a; Stamnes, 2004, p.45). When studying disk magazines, the origins and importance of parties were confirmed: already the Commodore 64 disk magazine Sex'n'Crime contained several references to the *Venlo* copyparty held in Germany in the late 1980s, and other diskmags discussed parties a great deal as well. While parties are often mentioned in demo-related publications, they have not been investigated in depth by other authors than Hege Nordli, who published an article written from a gender study standpoint and whose dissertation contains a chapter on *The Gathering*, a large Norwegian party (Nordli, 2003a,b).

In the early 1990s, parties increased considerably in size. Large meetings rapidly expanded into yearly happenings with thousands of visitors. For example, Stamnes (2004) mentions that in 1994 almost 1800 people visited *The Gathering*. According to the party database of *pouet.net,* other big parties of the early 1990s were the Finnish *Assembly,* Swedish *Computer Crossroads,* and Danish *The Party*. The Party eventually faded away in 2002, and Computer Crossroads did not continue past 1994. The other two still exist, even though in a rather different form. Another large party appeared in 1997 when the earlier German *Mekka* and *Symposium* meetings joined forces to become *Mekka & Symposium.* In 2003 the party ceased operation and was replaced by the yearly *Breakpoint,* also in Germany and still in operation. A notable difference between Breakpoint and other big happenings is its dedication to pure demoscene activities: "No gamers, no script kiddies, only creative people" (Breakpoint, 2009).

To categorize demo parties by their size the following taxonomy was devised:

- *Meetings.* A small-scale informal get-together of local sceners and their affiliates. No competitions or formal program. Up to tens of visitors, might even have a name. Often organized at private premises.
- *Small parties*. A formally organized happening with competitions, schedule and a group of organizers. May attract up to hundreds of visitors, even participants from other countries. Nowadays parties of this magnitude also have a website. A nominal

entrance fee is collected. Typical premises for small parties are for example schools and youth centres.

- *Big parties*. A large-scale international happening with up to thousands of visitors, taking place in a building as large as an ice hall or a fair center. Needs a large group of organizers with specialized hierarchies like security and network teams. Considerably high entrance fee and high-profile sponsors. Extras such as posters and t-shirts are sold. Fig. 3.4 depicts how the main hall looks like at a big party.

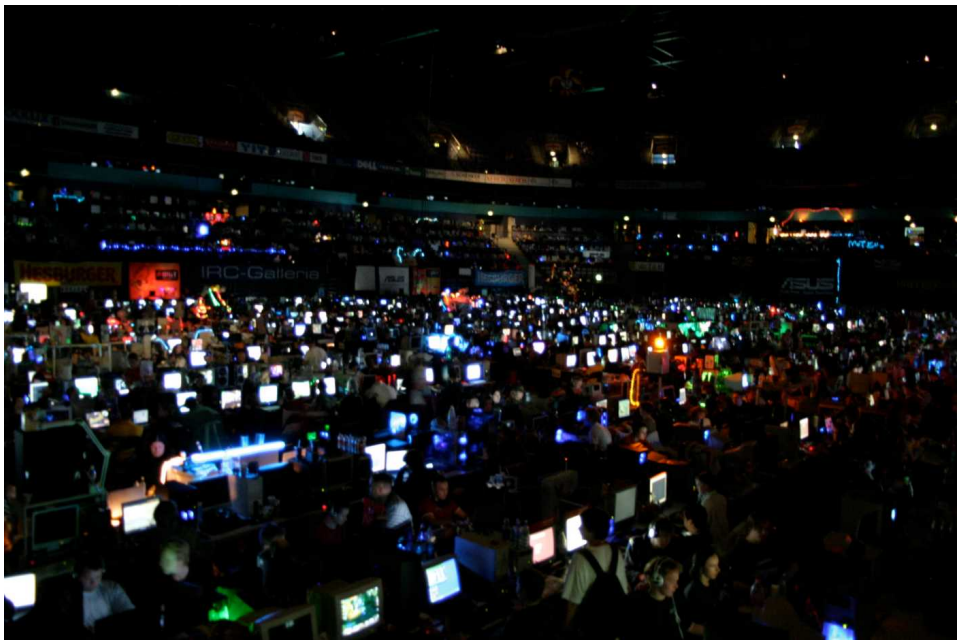

Figure 3.4: Assembly'05 main hall

When parties grow as big as the last category their nature changes considerably. Advertising, budgeting, planning, and sponsorship negotiations require a considerable investment of time and effort. A controversial theme appearing in numerous disk magazines has been the tendency of large demo parties to drift towards game-oriented *LAN parties*. From an economical standpoint such development is understandable: computer games bring in sponsor money, and game enthusiasts are a large audience. It is questionable if the current demoscene alone could even provide for several large happenings a year. On the other hand, the trend has been a constant source of contempt. For example, as seen above, *Breakpoint* clearly distances itself from the game parties. Already in 1995, *Diesel8* observed the development in R.A.W. #9:

> Last year's Assembly was probably the definite break-through for the PC-scene. Hardly anyone had brought their Amigas, but a lot of people were playing Doom on PC. This trend was even stronger this year – the handful Amigas were either left alone playing some old modules, or turned off. Com-

pared to Party IV, Assembly is definitely less scene-party and more game-geek-gathering.

Competitions (*compos*) are a fundamental part of the party culture and a good example of the competitive nature of the community. Different competitions let the groups plus individual programmers, musicians and graphic artists show their skills to the audience. The competition winners also receive prizes in the form of money, software and hardware. The most important prize, however, is the added fame and visibility of the group and the artist. Some of the most common types of competitions are:

- *Demo compo*. Traditionally the most important competition with the highest prizes.
- *Intro compos*. Size-limited intros, such as 64k and 4k intros.
- *Music compos*. Different categories such as instrumental, freestyle and four-channel/multichannel music exist.
- *Graphics compos*. Different categories such as raytraced, pixeled, ANSI, thematic and freestyle graphics exist.
- *Wild compo*. A competition with loose rules allowing exotic hardware, videos and even performances.

At times, competitions are split into smaller ones based on the hardware/software platform. Numerous other types of competitions can be found on party results and invitations: banner, fast, game development/playing, short movie and even sports competitions have taken place at parties. A *fast compo* refers to the tight time limit set for the creation of a complete work from scratch. For detailed discussion on the different types of artifacts see Chapter 4.

Competition results are decided by a public vote. A jury often reviews the entries before they are shown to ensure that they conform to the competition rules. Originally, the voting was conducted using voting sheets or diskettes (”votedisks”) and more recently it has been moved to the party network. Figure 3.5 portrays the user interface of The Party 1994 voting diskette. The voting process is not strictly controlled, which has at times lead to accusations of so-called *faking* or *fake voting*, where the results have been skewed. Charts have also been faked as seen already in Sex’n’Crime #21 (1990). Such accusations and discontent with *crowdpleasers* (technically unimpressive productions that appeal to the audience) are somewhat common after parties.

3.6.2 Swapping, Trading and Spreading

When new productions are created, they must be spread to the rest of the community. Traditionally, a *swapper* was responsible for the process and sent diskettes by mail to his contacts

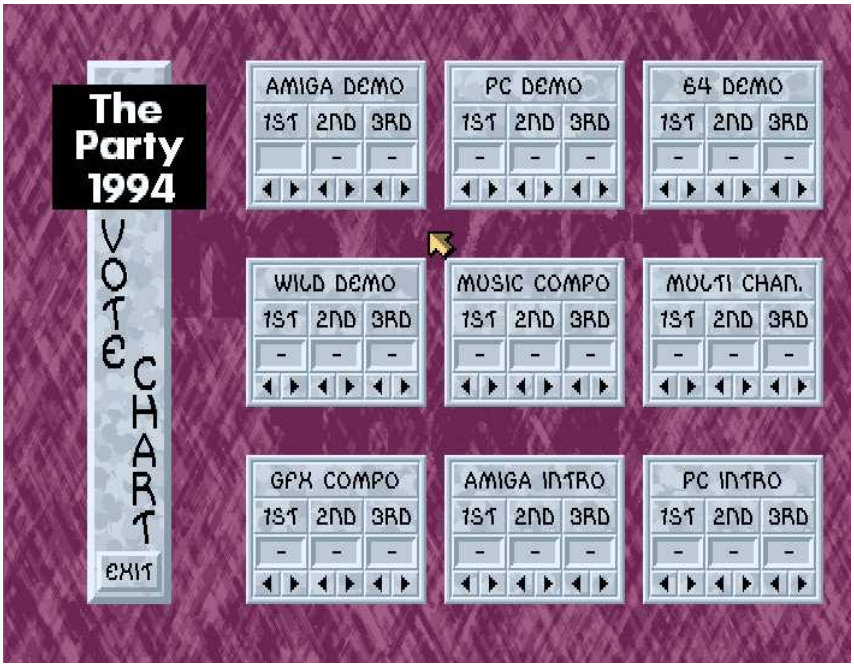

Figure 3.5: Voting diskette by Nuts from *The Party* 1994

in order to distribute the production through the interpersonal network. Swapping evolved into its own specific and demanding field in the 1980s, featuring factors like advertisements (found on most diskmags), *stamp faking* to save on postage costs (Polgar, 2005, p.52), and competition for most contacts and the newest "stuff" (Tasajärvi et al., 2004, pp.13–14). At times, the word *trading* has been used separately from *swapping* to denote modem-based distribution. Since the mid-1990s, the Internet started to increase its importance as a distribution channel and by 2000 it had practically made the earlier channels obsolete. Swapping/trading was international right from its earliest days, following the tradition set by cracker groups.

Demos are distributed for free: a fact so simple and obvious that it is almost too easy to omit it without further thought. With the exception of possible competition prizes, no money whatsoever is made out of the productions. In this sense demoscene encourages free and equal sharing, although the line is drawn at the source code of the demos, which usually are not published (see Section 3.3.1). The models of distribution have obviously not been inherited from the commercial world nor the hacker/free software paradigm. The closest equivalent and a direct predecessor is the cracker model that is based on free (although illegal) software trading, with honor being the main currency (Rehn, 2004).

Some curious counterexamples do exist, however. While some demo groups proceeded to game programming (Section 3.3.3), some actually made commercial demos for companies. Saarikoski (2004, p.210) noted that the Finnish demogroup *Future Crew* made demos for SSI and Creative Labs. Gruetzmacher (2004) mentions another demo from the same group, made for Waite Group Press and also an *Afri Cola* demo by the German group *Farbrausch*.

The homepage of the Dutch *Ultra Force* demogroup lists as many as five commercial demos (Ultra Force, 2007). Other examples can be found on *pouet.net*: Swedish *Triton* created a commercial presentation for Gravis UltraSound cards, and OS/2 promotional demos exist at least from three groups. Obviously, some of the top democrews had the intention of using their skills for commercial demo production, too. An oddity among the various subscenes is the isolated Dutch MSX2 scene that actually followed a commercial model: according to *comp.sys.msx* discussions and Szarafinski (1995), demos were sold to other groups at fairs, which indicates that the scene in question was in some respects more aligned with the commercial MSX2 world than with the worldwide demo community.

3.6.3 Online Interaction

Disk magazines, despite their digital nature, are still a physical medium that needs to be handed over to the next reader, and thus interactive communication between people is slow at best. Electronic communication media such as BBSs (Bulletin Board Systems), Usenet newsgroups and, more recently, web-based discussion forums offer a faster cycle and thus enable almost real-time conversation on topics of interest. Another difference is that diskmags are edited, require full articles to be written and therefore are at least somewhat moderated, whereas the online media let almost anything through.

Demo-related BBSs (*boards*) would be an interesting source of early online discussion, but due to their scattered nature their message bases are hard to access these days, and a significant amount of material may have been completely lost already. An early effort of bringing the demo-related boards closer to each other was the formation of *Creativity Demo Network* (Imphobia #12, 1992), which synchronized the member BBSs with each other. Soon thereafter, Usenet newsgroups like *comp.sys.ibm.pc.demos* started to gain ground as important forums (see Section 2.3.3). Old newsgroup discussions are significantly easier to access in comparison to bulletin boards, thanks to the *Google Groups* archive (Google, 2001). Finally, in the 2000s, newsgroups were chiefly replaced by general web-based forums such as *pouet.net* and platform-specific or thematic sites.

When comparing Usenet groups, such as *comp.sys.ibm.pc.demos* or *alt.amiga.demos,* to the *pouet.net* forum, it is easy to notice differences in the tone and topics of the conversations. The newsgroups are somewhat public and official forums, accessible to anybody, whereas Pouet can be thought of as a private corner of the demoscene. Coupled with the more serious nature of the community in the 1990s, it is easier to understand the differences. While newsgroup discussions chiefly consist of serious topics and debate (even fights), the Pouet forums are more geared towards pure pastime (which is not to say that real topics would not be debated as well). Examples of the laid-back discussion are the numerous ”Random *x* threads”, where *x* can vary from anything between ”girl with hardware” to ”line of code”.

Even serious threads are usually marked by humoristic remarks and *trolling* (controversial statements intended to heat up the discussion).

As can be observed above, the communication media are in a state of constant change. Disk swapping was challenged by modem trading, hand-written letters by BBSs, BBSs and disk magazines by the Internet and so on. Following Marshall McLuhan's thinking, new media inevitably and irreversibly shape the society and its practices (McLuhan, 1994). The developments in communication technology have certainly shaped the demoscene, too, bridging its geographical gaps and creating a sense of immediacy not possible twenty years ago. As an example of this change, a demo may appear on a website the same day it was finalized and it will immediately be available to any community member with an Internet connection. Debate on the merits of the production starts at once. Demos have been spread and debated since the beginning of the demoscene, but such immediacy has made the world a lot smaller in the spirit of the *global village,* as called by McLuhan.

3.6.4 Language

English is the *lingua franca* of the scene, as can be noted in practically all the source material of the study. Such a situation is hardly surprising due to the dominant status of the English language in the field of computing, popular culture and education. The international demo community (originally the cracker community) needed a shared language and chose the common denominator that more or less everyone understood. Even magazines such as *Illegal* and *Hugi* that started as 100% German ended up being published in English to better serve the international community.

Like any other established community, the demoscene too has its slang. The glossary on page vii, although far from exhaustive, contains some of the most common slang words used by the community. Some words are demoscene-specific, while some originate from common computing slang or the hacker community, as documented in *The Jargon File* (Raymond, 2003). Learning the shared language is part of the initiation process a new member needs to undergo to be accepted by the community. While English slang is a common denominator of the community as a whole, the national subscenes also have their own words.

The so-called *leetspeak*, common in the hacker culture (Thomas, 1991, pp.56–61), has appeared in the scene circles at times. The system basically consists of replacing letters with numbers and other symbols. Additionally the words may be twisted to resemble their pronunciation and their case may be changed arbitrarily. For a more detailed description see Mitchell (2005). *Elite hacker wares* might end up looking like *1337 h4x0r w4r3Z*. In addition to mere wordplay and style, such language is a way of consciously distancing the community from the outsiders. Mitchell suggests that it was also a practical method for circumventing BBS rules that banned certain words. Polgar (2005, p.41) also claims that

such language was used by software pirates to evade law enforcement. In the demoscene context leetspeak has appeared for example in infofiles.

3.7 Self-Reflectivity

Self-consciousness of the demoscene is revealed by the high amount of reflection that takes place in its discussions (see Section 4.6.2). The community is clearly aware of its own existence, borders and dynamics. It has also taken a name for itself, *the scene*, to emphasize its uniqueness. External factors, such as changing society and technologies, constantly impose new challenges on the demoscene, which must react in a way or another. Numerous debates on diskmags, web forums and newsgroups have been dedicated to the future of the scene in a changing world. Such discussions already feature a meta level: the scene is referring to itself as a high-order entity instead of only its concrete manifestations such as productions and parties.

Reoccurring themes during almost twenty years have been the looming death of the scene, platform wars, increasing hardware requirements, lameness, gamers and competition rules. Most of them can be reduced to the binary juxtapositioning of good/bad such as Amiga/PC, skilled/beginner, elite/lame, demos/games. The elite/lame distinction is discussed further in another article (Reunanen & Silvast, 2009). This way—at times almost violently—the community collectively evaluates its attitudes towards external changes that threaten the established and safe *status quo*. In a sense the process is democratic: anybody can try to affect the public opinion by participating in the debates, although the views of high-ranking members are likely to weigh more than the others. The following quotes illustrate the controversial nature of the process:

> So realize it – wake up! The future you are dreaming of does not exist! Stop doing AGA stuff and the splitting of our beloved Amiga scene! (Rufferto/Covert Action Team, R.A.W. #6, 1993)
>
> Also to all coders: Do not try to make more than you can handle! I really hate to see some simple vectors or other effects requiring a 66MHz Pentium or similar!! (Thomas/S!P, Imphobia #8, 1994)
>
> Nothing that Windows95 does can't be done (much better) with dos, and what is more important, I get the complete control over the machine (with no overhead even): a thing that Windows' Direct-xxx will never really give. (Fabio Bizzetti, *comp.sys.ibm.pc.demos*, 1996)

Even though the opinions stated in a debate might be completely opposite, both sides still share a common goal: they try to support the continuity and blossom of the community. For a nostalgic member changes may seem like threats to the very existence of the scene

(frame of reference in the past), whereas progressive members may want to ensure the longevity by keeping the scene accessible to next generations (frame of reference in the future). Interestingly enough, nostalgic attitudes can be found in disk magazines as early as in the early 1990s. Young demosceners who had started their career perhaps a few years earlier complained how the scene had changed for the worse and how ”back in the day” things were better. On one hand, such tendency illustrates the power of tradition, and on the other hand, it serves as an example of how the scene constantly evaluates and defines itself.

Chapter 4

Demoscene Artifacts

The activities of the demoscene revolve to a great extent around its various artifacts. However important, the artifacts are not created merely for the sake of experimentation or self-expression: they are, probably more than anything else, objects of communication meant to be seen by an audience. Most of the works are digital by nature and thus infinitely copyable, which has several implications on their creation and distribution. This chapter deals with various objects produced by the scene from a historical and technological standpoint, ultimately trying to reveal the reasons why the artifacts are created as they are.

The categories presented here are based primarily on the taxonomy used in the ”Prods” section of *pouet.net*. On one hand, the power of such taxonomy is that it is constantly evaluated by the community, and thus represents its views on the artifacts, but on the other hand, for an outsider it may not mean anything at all. Very similar kinds of taxonomies were present in other sources such as disk magazines, charts and competition results, which confirms that the community shares the naming conventions at any given time, while historically the same claim might not hold true. The overall impression one gets is that the scene is attracted to precise categories. An artifact is a demo or an intro but nothing in between. Such a tendency shapes the outcomes more than the other way around: instead of flexibly adapting the categories to accommodate any kind of work, the artifacts are made so that they readily Fit in the existing model.

Over time the plurality of artifacts produced has grown little by little, which can be noticed, for example, in disk magazines and party rules/results. While early sceners were happy (to simplify a little) with cracks, diskmags and demos, the current variety includes different types of music and visual works, demos of multiple kinds, diskmags, packs, videos and so on. This development is by no means surprising: the community itself has grown more sophisticated and appropriated or invented new forms of expression, supported on a lower level by the concurrent developments in software and hardware. In this case, the word

appropriation refers to the absorption of external practices from other contexts such as the popular culture, which too is under constant change.

4.1 Demos

To distill the essence of demos, we can define them as real-time multimedia presentations. Sometimes they have been likened to music videos, too, in order to explain the phenomenon to outsiders (Lönnblad, 1998, p.4; Saarikoski, 2001a). Demos can be considered the most integral artifact of the community, as illustrated by its very name: *the demoscene*. The most defining property of demo-like artifacts is their size. Smaller types such as 64k or 4k intros limit the means of self-expression, since they do not allow the authors to use pre-rendered music, video clips, or good-quality still images. Full-blown demos, on the other hand, allow for such content and therefore the outcome is restricted only by the creativity and the skills of the authors (as opposed to a tight technical limit). The size limit for a demo has increased over the years due to many reasons, such as increased screen resolutions, type of music, larger storage media and faster data communication networks. In general, it could be stated that the size limit has always been so comfortable as to let the artists focus on the content instead of size optimization. To give a few examples, some of the size limits at the yearly *Assembly* party have been as follows: 4 MB (1994), 6 MB (1998), 20 MB (2006) and 64 MB (2008) (Assembly Organizing, 1994, 1998, 2006, 2008).

The amount of existing demos is hard to determine. The estimate proposed here is based on the *pouet.net* website, since it represents all the demoscene hardware and software platforms. As of May 2009, the site contains 51,858 productions, which serves as a starting point for the estimate. The figure includes other types of artifacts too, such as disk magazines, videos and games, but it can rather safely be assumed that the majority of the productions are demos of some sort (demos, 64k intros, 4k intros etc.) since they represent the most common productions published at parties (still images and tunes are not listed). Surely not all the demos in existence are listed on the site due to numerous reasons: unknown productions may not be interesting enough to be added, some of them have never been officially published, some may have disappeared altogether, and simply because the community has not yet taken the trouble of adding them. If we assume—very conservatively—that for every demo on the site there exists another that is still missing we get a rough approximation of 100000 demos. As the actual number may be twice or three times as high, the order of magnitude alone reveals the vast amount of artifacts we are dealing with and the effort that has been invested into the demoscene activities.

4.1.1 Megademos and Trackmos

A *megademo* is a large multi-part demo, as opposed to early one-screen intros. According to *pouet.net,* the majority of productions called ”megademo” were released in the late 1980s or early 1990s, especially for Amiga computers, after which the word practically fell out of use. The newer appearances use the word either to emphasize their retro style, or ironically, when the production is something else in reality. Regardless of such change, even many modern demos could actually be defined as megademos, since they feature several separate parts and are large in size.

Figure 4.1: *Red Sector Megademo* (1989)

The original purpose of a megademo was to be a massive *tour de force* of a group, displaying its skills in different areas like programming, music and graphics. When considering a traditional megademo, it most often consists of a sequence of unconnected parts each showing one important effect or other content such as a still image or animation. A loading screen between the parts is another common property of old megademos. The newer *trackmo* style demos of the early 1990s loaded the next part already while showing the current one and did not need loading screens. The continuous trackmo style became standard and still remains so, although modern day productions do not necessarily need to load anything from the disk during the execution. Technically, ”trackmo” refers to loading data directly from diskette tracks using a *trackloader* subroutine, bypassing the slow operating system file handling.

Most modern demos do not require (or even allow) any user interaction, but classic megademos often required a key press or mouse click in order to advance to the next screen. Some of them even had an interactive selector where the viewer could choose the desired part. Such practice was especially popular on some platforms, most notably the Atari ST. Figure

4.1 shows the loader screen of the well-known *Red Sector Megademo* (1989), which precisely fits the format of an oldschool Amiga megademo described above (see (Botz, 2008, pp.100–106) for an in-depth analysis of the demo in question). Botz (2008, p.135) links the disappearance of interactive demos to the growing importance of demo parties: a linear show filled with impressive effects was suitable for demo competitions.

4.1.2 Demo narratives

The most common structure of a demo is a predefined linear sequence of effects. In some rare cases, the sequence is varied with dynamic elements that change every time the production is run. A notable exception to the rule is the interactive megademo type (see Sections 4.1.1 and 5.2.2) that does not follow a rigid structure, but lets the user freely decide the order of effect screens instead. The individual screens, however, typically follow a linear narrative, progressively improving the effect to impress the audience.

While any temporal sequence ultimately forms a narrative, intentional storytelling in demoscene productions is a rare phenomenon. Productions known as *story demos* are examples of the opposite. Story demos highly resemble short films with elements like narrative text or narrator voice, soundtrack, sound effects, cuts and a storyline. Such resemblance is hardly a surprise, according to Manovich (2001), who claimed that many narrative structures of new media originate from cinema. In addition to pure story demos, lightweight storytelling can be found in demo texts that at times constitute stories on their own. The role of text in demos has not been studied so far, with the exception of a seminar paper written by Hartmann (2008), who analyzed five demos from a literary point of view.

4.1.3 Themes

Demos, unlike many other forms of media art, seldom try to convey political, religious, or social messages to the audience. Anecdotal evidence of political commentary in demos does exist, but in general such themes are scarce (Fig. 4.2). In addition, it is questionable whether such content is meant to be taken as a statement, because symbols loaded with meanings and opinionated rhetoric styles may equally well serve the purpose of stylistic experimentation.

When compared to ”serious topics”, humor is a much more common theme in demoscene productions. Different kinds of *joke productions* exist for the sole purpose of giving the audience a good laugh. Such productions are often made by *joke groups* that operate outside the traditional lame-elite dimension (see also 3.5). Joke productions range from intentionally badly designed and implemented demos to laboriously crafted megademos that use humor as their main theme. Humor in demos is a broad topic, ranging from adolescent jokes to references to popular culture or other demos. Even some parodies of well-known

Figure 4.2: Political and religious themes. *Red Storm* by Triad and *Paimen* by Coma.

demos exist: *Sqrt(2) Reality*, *Real Reality* video (parodies of *Second Reality*) and *Rope* (parody of *Dope*), to give three examples. Roininen (1998, p.64) also mentions joke demos in her thesis, describing them as intentionally badly made demos that amused some and bored the others.

4.1.4 Development of Effects

The basic format of a demo is a collection of real-time *effects*, possibly but not necessarily tied together by transitions and a consistent visual style. The fundamental property of an effect is its visual fidelity: it needs to look impressive. A high-quality effect is visually impressive, original and technically advanced at the same time. Especially in the era of limited computing power, the technical execution was highly regarded (see Section 4.3).

When analyzing the demos listed in Appendix B, their effects were first collected into lists. Next, the data were combined so that for each year, a list of effects and their frequencies (number of demos where it appeared) could be calculated. For a single year there were possibly as little as three demos, which was not sufficient to reveal large-scale trends. Therefore, the time span was broken into five-year periods, and the respective lists were combined. Dividing the effect frequency by the demo count yielded the percentage of demos that featured a certain effect, and let us compare their relative popularity during each period. Another possible approach would have been to count all the occurences of all the effects and compare them to the amount of all the effects. However, such an approach would have required significantly more effort, and on top of that it would have introduced an additional problem: what to do, when an effect is a combination of two or more? Does it count as multiple effects? Counting the demos instead circumvented the problem.

The first period, from 1985 to 1989, is presented in Table 4.1. The most obvious finding is that practically all the demos contained *scrollers* in some form. Text moving across the screen was a fundamental element in crack intros, featuring greetings to other groups, information on the crack itself, and credits. The young demoscene of the late eighties

Effect	%	Effect	%
scroller	95	wobbler	26
colorbars	37	starfield	26
sprites	32	2D animation	21

Table 4.1: Most popular effects from 1985 to 1989. Percentage of demos featuring a certain effect.

largely inherited the effects of the crack intros and, thus, early demos also feature a great number of different scrollers. *Colorbars*, *sprites* and *wobblers* can be directly mapped to the capabilities of hardware at the time (see Sections 5.1 and 5.2).

Effect	%	Effect	%	Effect	%
scroller	78	writer	25	dot vectors	22
flat shaded vectors	72	zoomer	25	plasma	22
2D/3D animation	44	vector balls	22	image morph	22
starfield	28	landscape	22	tunnel	19
sprites	28	rotozoomer	22	line vectors	19

Table 4.2: Most popular effects from 1990 to 1994. Percentage of demos featuring a certain effect.

As can be seen in Table 4.2, scrollers were still fashionable in the early nineties. Almost as popular were flat shaded 3D vector graphics, such as cubes and space ships. Commodore Amiga, the dominant demo platform of the period, was well suited for such graphics with its hardware-assisted polygon filling and relatively powerful 32/16-bit CPU required for the mathematics involved (see 5.2.1 for further discussion). 3D graphics had definitely made their breakthrough, since line- and dot-based vector graphics plus *vector balls* were frequently seen in demos. Such a development also reflects the increasing sophistication of demo programming. Another notable trend is the appearance of image-based effects such as different *zoomers*. Tunnels appeared already in the early nineties, but became much more popular a few years later, as can be seen below. Overall, the growing variety of effects is apparent when compared to the very first period of demoscene productions.

Effect	%	Effect	%	Effect	%
texture mapped vectors	61	scroller	27	metaballs	21
radial distortion	55	shaded vectors	27	particles	21
tunnel	39	bump	27	flyby	21
image distortion	33	flat shaded vectors	24	rotozoomer	21
line vectors	30	floor	24	2D/3D animation	18

Table 4.3: Most popular effects from 1995 to 1999. Percentage of demos featuring a certain effect.

The period between 1995 and 1999 could be described as the golden age of software-rendered 3D graphics and image distortions. Texture mapped vector graphics rapidly gained popularity in the late nineties, as can be seen in Table 4.3. The development was supported

by the increasing processing power and graphics modes better suited for texture mapping (Section 5.3.1). At that time the PC had already taken over the home computer market and become a major player in the demoscene, too. Most importantly, however, texture mapping can be seen as an example of scientific knowledge entering the community: in the field of computer graphics the technique had been used for years. Flat shaded vector graphics had already become old-fashioned and vector balls disappeared almost completely. *Bump mapping, metaballs* (3D balls melting together when they come close to each other) and *particles* can be taken as additional examples of programming tricks absorbed from the field of computer graphics.

Various image-based effects, such as radial distortions, distortions by curves and *roto-zoomers,* frequently appeared in demos. In addition, some of the tunnels can be counted as radial distortions, since they are based on the same method of mapping a 2D image into polar coordinates. Some effects, once popular, had already lost their prestige. For example, scrollers could be seen in only 27% of the analyzed demos, and moving 2D sprites had disappeared altogether.

Effect	**%**	**Effect**	**%**
texture mapped vectors	63	image distortion	32
2D/3D animation	47	particles	32
flyby	42	ribbons	21
tunnel	42	blur	21
shaded vectors	32	floor	21

Table 4.4: Most popular effects from 2000 to 2004. Percentage of demos featuring a certain effect.

Effect	**%**	**Effect**	**%**
texture mapped vectors	57	particles	29
shaded vectors	43	scroller	29
landscape	43	flat shaded vectors	29
ribbons	36	tunnel	29
flyby	36	2D/3D animation	29

Table 4.5: Most popular effects from 2005 to 2009. Percentage of demos featuring a certain effect.

Affordable powerful 3D accelerators started to gain support in demoscene productions from 2000 onwards. High polygon counts and increasing resolutions were the biggest differences compared to the previous software-rendered 3D effects. The polygon became the principal graphical primitive, and most of the popular effects of the last ten years clearly reflect the development (see Tables 4.4 and 4.5). Animations and tunnels that used to be 2D effects turned into 3D animations and vector tunnels. Notable newcomers in the figures are *ribbons*, moving polygonal stripes and tubes. Interestingly, there seems to be little difference between the two last periods. During the first fifteen years of demoscene productions the development was rapid, but lately the pace seems to have slowed down to a certain extent.

There are several possible explanations to this, but one factor certainly is that computer hardware has reached such a level that it does not effectively limit the creative aspirations. Creativity, tools and the complexity of high-end programming are likely to be the current limiting factors as opposed to mere processing power.

4.2 Size-Limited Intros

While demos have grown in size all the time, the size limits of *intros* have remained fixed for a number of years. The most typical sizes at competitions are 64 kB and 4 kB, but several other sizes such as 1 kB, 256 B and even 64 B exist. The word *intro* refers to the cracker roots of the demoscene: little screens with effects called *crack intros* were placed at the beginning of illegal software to display the name of the crackers and to send messages to other groups. The name became so rooted in the culture that it still remains in use, although there is very little in common between crack intros and the intros of today.

Why impose such completely arbitrary limits on productions? Crack intros needed to fit in small size and the early home computers often had only 64 kilobytes of memory, but such limitations have had little foundation since the 32/16-bit generation. Tradition may be counted as one, although insufficient, reason. More credible explanations lie in the demoscene's aim to break borders and do the impossible. To create a high-quality audiovisual presentation in small space is considered more valuable than doing the same without limits, although to the viewer both might look exactly the same. Even a video clip would provide the same experience, but it is in dire contrast with the real-time practices of the scene. Creative process, when constrained by almost impossible limits, forces the artist to push the boundaries of the medium, to circumvent the limitations and to constantly rethink his approach. For examples of the same phenomenon in other domains, one might consider artforms such as calligraphy, haiku poems, miniature paintings and ornaments.

Although a few kilobytes of storage space have hardly been of importance during the last twenty years, there is one counterexample as well. So-called *BBS intros* used to accompany demos in the same compressed archive in the 1990s. Their purpose was to advertise a bulletin board system in an interesting manner. The intro would be added to the archives distributed at the site and therefore it needed to be small: a large file would have increased download times to the discontent of the users. Fig. 4.3 portrays an example of a BBS into.

4.2.1 64k Intros

64-kilobyte (65536 B) intros have been established as a common category of demoscene productions, although somewhat equal categories such as 40k and 96k intros have existed in the past as well. The size limit contains a reference to binary numbers (16 bits or 2^{16})

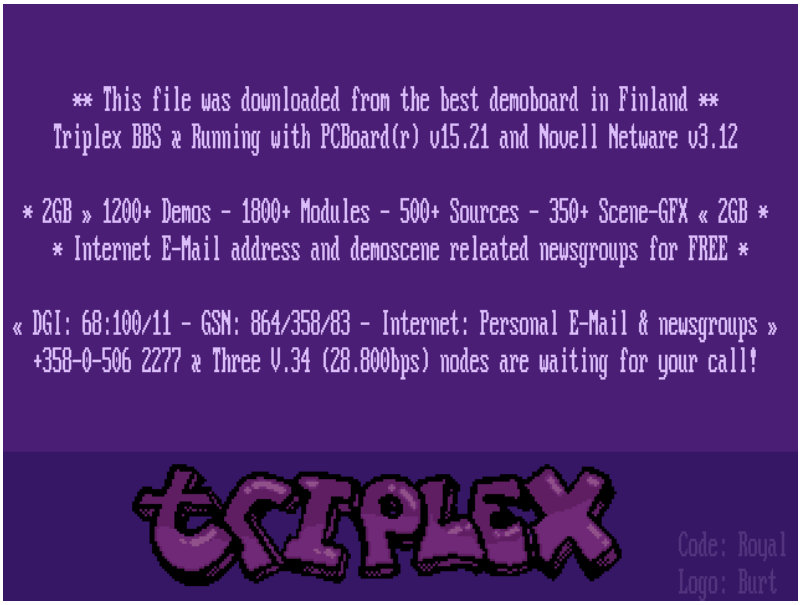

Figure 4.3: A BBS intro for *Triplex BBS*

and to early home computers such as the Commodore 64 that had 64 kilobytes of RAM. A typical 64k intro is one executable file containing all the required code and data. The limit is an absolute maximum—it may not be exceeded even by one byte. Figures 4.4 and 4.5 contain two examples of this category: a 40k intro from the year 1994 featuring flat shaded vector graphics and a 64k from the year 2000 with ray tracing. Figure 4.4 also serves as an example of the early 1990s Amiga style, and 4.5 features the artistic white texts typical of its time.

Such limited space requires its own approach from the authors. A common technique is the use of data compression: all the required code and data are compiled into one executable, which is then fed to an executable compressor such as *Pklite* (MS-DOS 16-bit), *pmwlite* (MS-DOS 32-bit), *StoneCracker* (Amiga) or *UPX* (multiplatform). The resulting program contains a stub that decompresses and executes the original code transparently.

However, data compression alone does not solve the size dilemma. In comparison to pre-rendered music and still images, program code tends to be relatively small, which inevitably leads to the use of algorithmic methods to create the audiovisual content. Small still images, such as logos, can be fitted in as seen in some 64k's, but high color and pixel resolutions are out of reach even when dealing with compressed data. Likewise, audio needs to be either minimalistic or generated through sound synthesis. More discussion on sound synthesis is provided in Section 4.5.4. In all size-limited intro categories, the role of the programmer is emphasized in contrast to demos that allow a richer variety of media types.

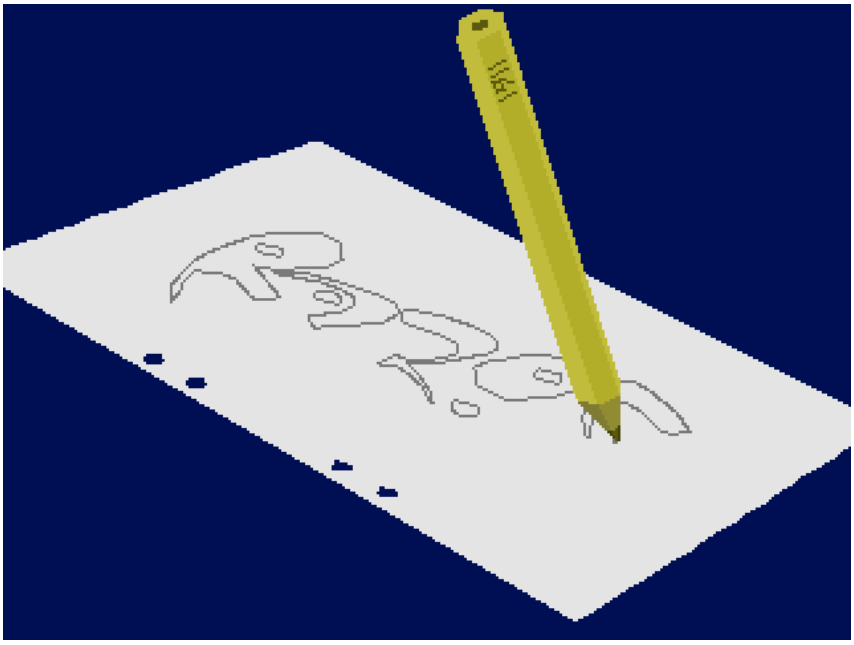

Figure 4.4: *Falu red color* by Razor 1911 (40k 1994)

4.2.2 4k Intros

In comparison with 64k intros, the 4 kB (4096 bytes) intros are an even more challenging category, being only $\frac{1}{16}$th of the size of the former. Such a constraint introduces completely new obstacles and limits the available media types in practice to program code: even the smallest sound sample or still image would be big in this context. The role of the programmer is emphasized even further, since most of the content needs to be generated algorithmically. The techniques and tools presented here are chiefly based on the *IN4k* website (IN4K, 2005), dedicated to sharing knowledge among programmers interested in 4k intro programming.

As can be observed on IN4K (2005), the 4k category has given rise to a number of methods to ease the size limit. Specific tools have been created for compression (a compressor adequate for 64k intros may be unusably big) and executable tweaking. The properties of the executable file format, dynamic loading of libraries and compilers are all exploited to free bytes for the actual content. Special programming styles are employed to minimize the overhead of compiled code and even minimal virtual machines have been proposed to reduce the precious size.

According to *pouet.net,* the first categorical 4k intros date back to the *STNICC 1990* competition that featured 3.5k entries. By the mid-1990s, big parties too started to accept them in competitions with *Assembly'94* being among the first (Assembly Organizing, 1994). The technology of 4k intros has undergone a dramatic change since those times (in this discussion we do not consider, for example, crack intros that could fit in the definition too). While

Figure 4.5: *Heaven Seven* by Exceed (64k 2000)

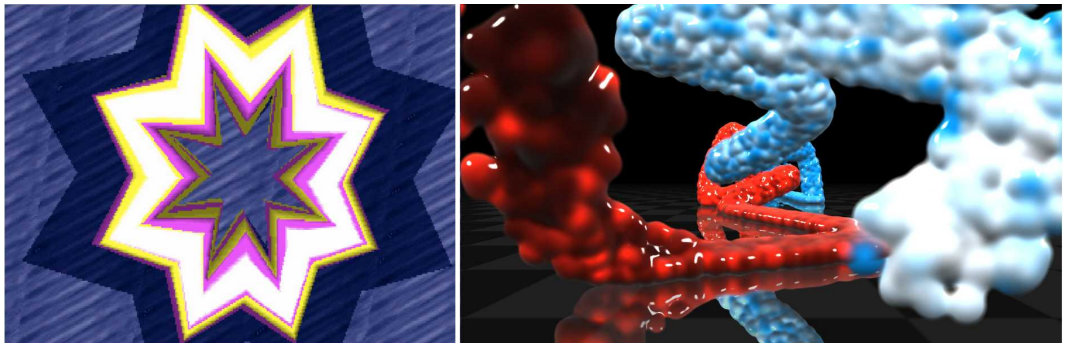

Figure 4.6: Two 4k intros. *Pure Spirit* by Spirit New Style (1996) and *Nucleophile* by Portal Process and TBC (2008).

early attempts ran on platforms such as MS-DOS and thus had to be self-contained (due to the simplicity of the operating system), new 4k intros have a variety of APIs such as *OpenGL*, *DirectX* and sound/speech available through the operating system. The same general trend from hardware pushing to system-friendly programming is discussed in Chapter 5. The development has also been a source of controversy: what is the actual role of the programmer when using external libraries that do complex things for free (Scholz, 2007b)? The requirements for the intros have grown equally: in the 1990s sound was not even allowed in 4k competitions (see Assembly Organizing (1998) for an example), while these days, a high-ranking intro needs to feature quality sound in addition to the visuals. The switch from home-grown 3D vector routines to hardware accelerated APIs is easily notable in the technical and aesthetic properties of 4k intros: low resolutions and simple vector graphics have evolved into polished 3D shows, as can be observed in Figure 4.6.

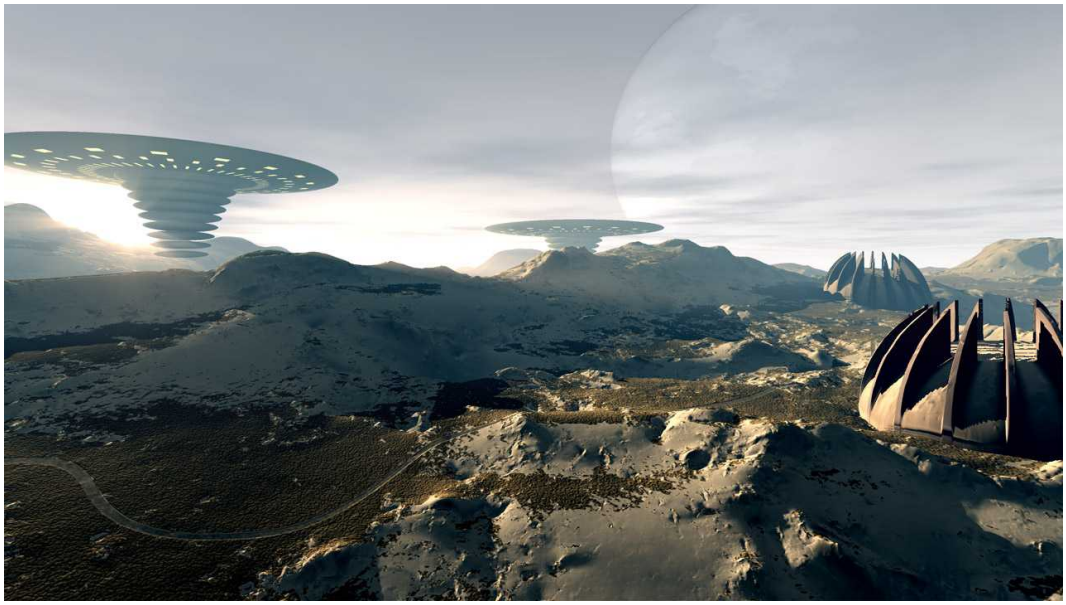

Figure 4.7: *Ixaleno*, a 4k procedural graphics entry by RGBA

Rather recent newcomers among size-limited intros are the *procedural graphics*. The first ones listed on *pouet.net* are from the *Buenzli* party of the year 2005. Such programs do not feature real-time effects, animation or sound. The only aim in the category is to create a good-looking image by using all means available. Technically, procedural graphics can be categorized as 4k intros, as they have multiple features like compression and programming approaches in common with the more traditional counterpart. However, without sound and animation there is more space for the image generation code and, thus, better visual fidelity can be achieved (see Fig. 4.7). Procedural graphics most often appear in a separate competition instead of the real-time category.

4.2.3 1k Intros and Beyond

The minimalism does not end at 4096 bytes. Even smaller intros are present on *pouet.net*, down to a mere 32 bytes. The next category after the 4k intro is the 1k intro (1024 bytes). Cutting down another three kilobytes limits the expression to more or less one single effect that can be parameterized to make the visuals more dynamic. Due to the executable file overhead, little space is left for the actual program code. Code compression is still possible and the operating system APIs can be accessed, but in general 1k intros tend to look like simplified 4k intros.

To go beyond one kilobyte, down to 512, 256, 128, 64 and 32 bytes, effectively rules out the use of APIs, high-level languages, code compression and ultimately even the executable formats of advanced operating systems. Based on the production lists of *pouet.net,* the most popular platform for such tiny intros is MS-DOS, chiefly due to its executable format that

Figure 4.8: *Tube* by 3SC, a 256-byte intro for MS-DOS

does not contain anything but the program code itself. In addition, graphics can be output with very little overhead and the computing resources are higher than on 8-bit machines that have equally simple executable file formats. Tiny intros usually contain one single effect with no sound (see Fig. 4.8 for an example). Such pushing of completely artificial limits could on one hand be considered the culmination point of the demoscene's striving for technical perfection, and on the other hand, a representation of the scene's tendency to create and adhere to its rigid taxonomies.

4.3 Demo Aesthetics

The aesthetic style of demos is affected by the hardware capabilities, production tools, skills, computer games, community likes/dislikes and the popular culture, all of which have changed rapidly during the last 20 years. Productions from the late 1980s are completely unlike their counterparts these days, both technologically and aesthetically. Currently, the most significant contribution to the discussion is the doctoral thesis by Botz (2008). Lönnblad (1997, 1998) analyzed demoscene music, Kurki (2002, p.57–62) used *Moppi Productions* as a case example when discussing developing visual styles, and Simmonds (2001) described some of the most common aesthetic traits of demos. Scholz (2007a) also includes some discusson of aesthetics in his article about the demo group *ASD.*

4.3.1 Hardware-Dictated Early Years

For quite many years demos were marked by hardware pushing, doing the impossible. The newborn demoscene did not have traditions, so the audiovisual language had to be constructed from scratch by absorbing visual traits from other domains. At first, the most important frame of reference was computer games: early demos and crack intros look like opening screens of games, with effects on top. Visually thinking, game names were replaced by group logos and game credits/instructions with demo credits or greetings. Figure 4.9 displays the opening screen of *Bubble Bobble* side-by-side with a crack intro by Ikari to illustrate the relationship. The lack of music authoring tools forced groups to *rip* game music to their productions, which made them even more game-like.

Figure 4.9: *Bubble Bobble* opening screen by Software Creations (1987) and Ikari crack intro from 1988

The properties of 8-bit hardware heavily affected the aesthetics. The first effects were scrollers, colorbars and moving sprites—things the machines were directly capable of with low-level programming. Most early home computers were based on character graphics: the screen was divided, for example, into 40x25 characters that could be changed and copied. The character block size, typically 8x8 pixels, is easily observable in the visual style of demos made for 8-bit computers. Likewise, the aesthetics of demo music were deeply marked by the properties of the rather simple sound chips until the Commodore Amiga with its module music changed the course of demo music (Section 4.5.2). More insight on the relationship of computer games, 8-bit hardware properties and early demo aesthetics can be found in the dissertation by Botz (2008, pp.53–69).

Distinctive early demo aesthetics have already become a source of nostalgia. *Retro* or *oldskool* productions mimic the early style on much more capable platforms. Old effects implemented using hardware accelerated graphics and CD-quality sound do not share anything else with old demos than the audiovisual references. Similar trends can be observed outside the demoscene too, in the form of retro-inspired new media art, retro style music and remakes of old video game classics (see Section 4.5.1 and Heinonen & Reunanen (2009) for more discussion on the retro phenomenon).

4.3.2 Appearance of Demo Design

Specific design discussions appeared on disk magazines in 1993 (Imphobia #7, R.A.W. #5). Sex'n'Crime already had some rare references to design in 1990, but the in-depth treatment of the subject can be considered a thing of the early or mid-1990s. Naturally, productions had always been designed in one way or another, but the concept of design had not been considered a separate entity. The first "design demos" appeared on the Amiga line of computers, whose established demoscene had passed the peak of pure technical show-off in the early 1990s. Increasing visual sophistication can be observed in Figure 4.10, depicting the design demo *Groovy!* by Lemon. (Lemon Point). What is understood by "design" in this context notably differs from other fields of study, such as user interface or industrial design. According to *Mount/Parasite* (RAW #5, 1993), good demo design consists of the following ingredients:

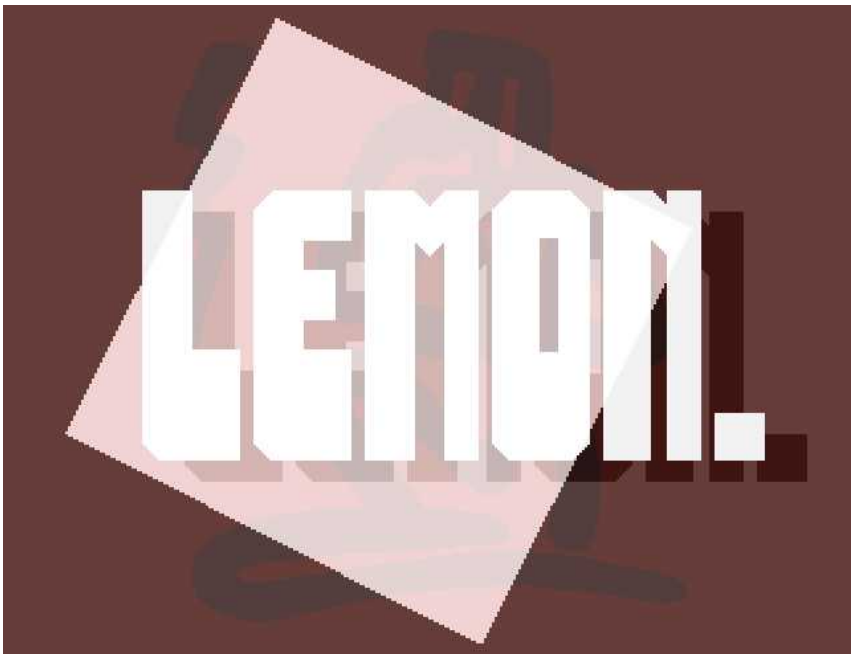

Figure 4.10: *Groovy!* by Lemon. (1993)

- Color scheme
- Composition
- Speed
- Homogeneous appearance
- Never letting the viewer get bored. The writer suggested that an ordinary effect should be shown for 5–10 seconds only.

The article represents the views of the Amiga scene. On the PC side, the same topic was dealt with by *Darkness/Imphobia* who admitted that PC demos were usually badly designed, but also noted that the tide was turning (Imphobia #7, 1993). He even went so far as to suggest the use of storyboards for demo design—a method used in numerous other fields of art and design. The article seemed to spark interest, since the following issue of Imphobia featured four articles on design alone. *Baldric/Extreme* brought up the importance of transitions between effects and synchronization with music (”music sync”). The other articles also reflected the same definition of design and acknowledged its high importance.

Visually the demoscene productions have increasingly started to contain postmodern features. Old demos and discussions reveal a strong concept of authorship: one needed to make one’s productions from scratch. Such attitude bears resemblance to the heroic artist-as-genius trend of western art. As Kiia Kallio summed up in *comp.sys.ibm.pc.demos* in 1993:

> ANYONE WHO COPIES PICTURES IS A LAMER!!! As an gfx-artist I am very well aware of how difficult it is to make a good picture. The reason why paintings are copied is that IT IS SO MUCH EASIER.

The Internet provided a wide variety of easily accessible graphical material, such as photos, starting from the mid-1990s, which was coupled with the introduction of the popular *Photoshop* software, designed for the editing of existing material. The development is immediately noticeable in the demos of the era: hand-drawn graphics were replaced by overlays consisting of edited images. The programmed content, too, was increasingly presented as filtered layers. Similar general trends in new media were observed by Manovich (2001, pp.129–160), who claims that a postmodern author bases his/her works on compositing pieces of existing media objects. Manovich also draws parallels to experimental cinema, such as Sergei Eisenstein, and painters like Pablo Picasso and Georges Braque, and portrays them as the forerunners of postmodern composition/montage in media.

4.3.3 Frames of Reference

When seeking audiovisual inspiration, the demoscene both reuses its existing trends and reaches out to other domains. When a new style, originating from an external frame of reference, is adopted by influential authors it gets diffused inside the community and may end up being a new dominant trend. So strong is this following that demos published approximately at the same time typically resemble each other in many respects. New effects are diffused the same way and affect the demo aesthetics on their behalf. To mention two notable frames of reference, the early 1990s graphical style was fantasy-oriented (Section 4.4.1), and was replaced by collage in the late nineties (Section 4.3.2 above).

Figure 4.11: *Full Moon* by Virtual Dreams from 1993, displaying an effect resembling *Wolfenstein 3D*

Games, as discussed in Section 4.3.1, were among the first frames of reference in demo aesthetics. Their influence has never completely disappeared and audiovisual references to games can still be found in numerous demos. Examples of direct references are the popular *Wolfenstein 3D* (published by id Software 1992) and *Doom* (id Software 1993) parts, where the viewer is taken through a maze of texture-mapped walls. In this particular case, the adoption was extremely rapid, as can be seen in Figure 4.11, which depicts *Full Moon* from 1993. The appearance of real-time 3D graphics in games, later enhanced by techniques like texture mapping and shading, was also reflected in the countless *object shows* of the nineties.

The popular and even the high culture of each era are reflected in the demoscene productions. For example, the layered collage style was most likely adapted from television commercials and music videos. This assumption is supported by Roininen (1998, pp.95–98), whose interviewees named commercials, movies and rock videos as their sources of inspiration. Demos have been likened to music videos (Lönnblad, 1997, p.24; Saarikoski, 2001a), and the two formats indeed share some properties: duration of a few minutes, synchronized combination of visuals and audio, montage and other cinematic techniques like cuts and camera rides. The real-time nature of demos and the low use of video footage technically separate the two, even if the end result might at times look similar. To exaggerate a little, the visual content in music videos is subjected to the audio: it is a video track for the song, whereas music in demos could be called a soundtrack for the visual effects. Figure 4.12 portrays *State of the Art*, a pioneering techno demo from 1992. The audiovisual style closely resembles music videos, but the visuals are drawn in real-time. Two clear-cut examples of popular culture being absorbed by the scene are the popularity of techno music (see Section

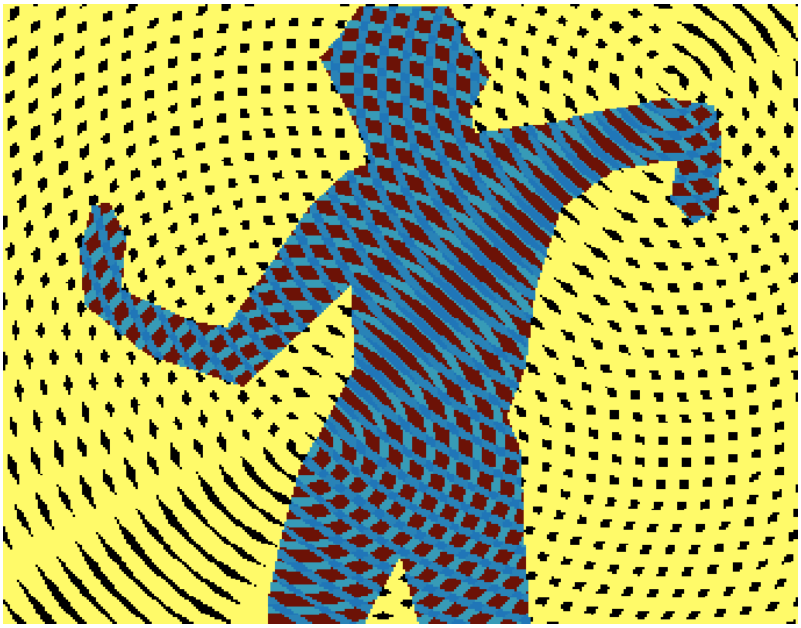

Figure 4.12: *State of the Art* by Spaceballs (1992)

4.5), and the themes and styles found in still images (Section 4.4) in the early and mid-nineties. More recently, the hip-hop and graffiti cultures have also become popular frames of reference, which was revealed when studying demos produced since the late 1990s.

4.4 Visual Artifacts

Visual artifacts such as artistic still images, group logos, 3D models and ASCII art constitute a major part of the visual language of the demoscene. They are created for several different purposes: demos, intros, competitions, artpacks, slide shows, disk magazines and infofiles are the most common uses. These artifacts are static by nature, but may also become live when animated and effected through programming. Like all the other artifacts of the scene, they have changed significantly over time, due to factors such as improved pixel and color resolution, development of authoring tools and new visual styles in the popular culture.

4.4.1 Still Images

Still images can be considered the counterpart of paintings or drawings of the non-digital world: they are static, two-dimensional and, in theory, offer an unrestricted medium for artistic self-expression (theoretically thinking, with 24 bits per pixel and a resolution of 640 by 480, the possible amount of different combinations is as high as $2^{7372800}$). At times, still images are created for specific competitions at parties, and at times they are used to support other content, such as in demos and disk magazines.

As demo effects represent the skill of the programmer, still images are the showcase of the graphic artist, ”the graphician”. In some sense the art of the demoscene is in line with very old traditions of visual arts, such as renaissance painting: in addition to an interesting theme and good composition, the technical execution of the work has to be perfect to be approved. The traditional way of creating still images has been *pixeling*, the drawing and editing of an image at pixel level. With low color and pixel resolution, the challenge was to create good-looking pictures with such limited means. As an example, a typical image on the Commodore Amiga was 320x256 pixels with 32 colors. For years, the fundamental tool for pixeling was Electronic Arts' *Deluxe Paint* (1985–1994), observable for example in the amount of iff/lbm images in competitions and in the interviews of GFXZone (2000). Higher resolutions and improved software (e.g. *Photoshop*) eventually diminished the need to tweak images at pixel level and, together with new visual styles, changed the face of demoscene graphics. The development of still images can be observed, for example, in the image collections of GFXZone (2000), Vigh (2003) and Vigh & Polgar (2006).

Figure 4.13: Examples of fantasy style by Titan, Cougar and Suny

Two popular styles of demoscene art have been fantasy (Fig. 4.13) and collage. The controversial collection of demoscene still images and the original works called *No Copy?* (Pärssinen et al., 1998) reveals the sources of inspiration of many recognized scene artists. The works of fantasy artists such as Frank Frazetta, Luis Royo, Hajime Sorayama, and especially Boris Vallejo have been pixeled to still images over and over again. Interestingly, one can find references to several other genres as well: the paintings of Salvador Dalí, H.R. Giger, Odd Nerdrum and even Ferdinand von Wright have been reproduced among others. Such references reveal that scene artists have been aware of the so-called ”gallery art” and looked for inspiration in it too. The methods and values of the 1990s scene art were further elaborated by Geurtsen (2000), who regarded mere scanning as taking a shortcut and redrawing as a way of learning. The older images of the ”No Copy?” gallery represent the age of *fantasy/Deluxe Paint*, whereas the newer ones can be categorized as *collage/Photoshop*. A similar trend can be observed in the collections of Vigh (2003) and Vigh & Polgar (2006).

4.4.2 3D Objects

Realtime 3D vector graphics appeared in demos in the late 1980s in the form of simple wireframe vectors, flat-shaded objects and balls rotated in 3D space (see Fig. 4.14). Even

such basic vector graphics require rather advanced knowledge about mathematics, such as transformations and projection. While the first 3D objects were extremely simple, the level of sophistication improved quickly, and already in the mid-1990s, demos contained considerably more advanced techniques as can be observed in Figure 4.14 on the right. The demo portrayed already featured texture mapping, combined with bump and environment mapping. Further technological developments, such as 3D acceleration (Section 5.3.4), both provided new possibilities and increased demands on the quality of the graphical representation.

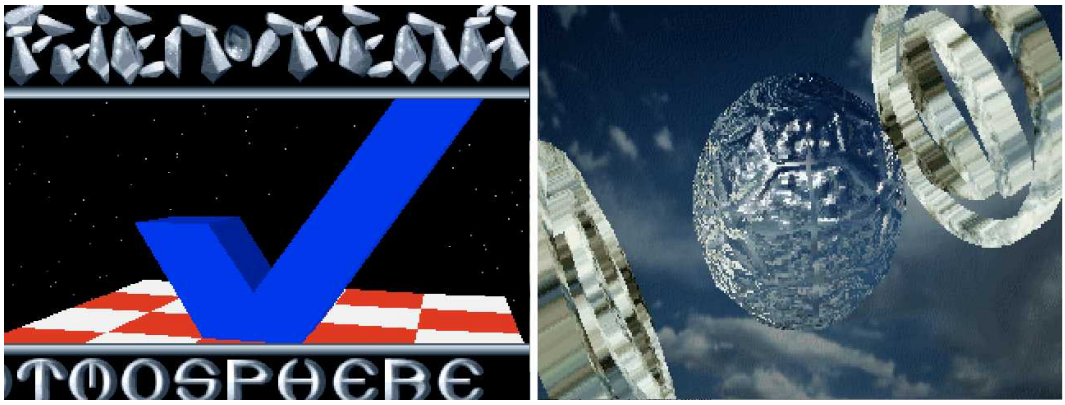

Figure 4.14: *Vectormania* by Phenomena (1990) and *Solstice* by Valhalla (1995)

Simple models can be, for example, sketched on paper and typed in by hand, so early on there was no demand for extensive 3D modeling. Neither was the hardware capable of displaying complex objects. An algorithmic approach enables the creation of models of higher polygon count, as seen in numerous demos displaying regular forms, such as spheres and tori. But creating realistic objects, such as a texture-mapped human figure, ultimately requires special software for the manipulation of the polygon mesh. Modeled objects started to appear as early as in the mid-1990s, and have thereafter become a standard component of demos, further enhanced by keyframe animation for the movements. Another use for 3D modeling in the demoscene has been raytracing: raytraced still images have appeared in demos, graphics competitions and in wild competitions in the form of animations.

4.4.3 ASCII and ANSI Art

ASCII (American Standard Code for Information Interchange) and ANSI (American National Standards Institute) are two well-known standards for representing textual information. ASCII dates back to 1963 when it was established as a national standard for text interchange (ASA, 1963). The ANSI code contains a richer set of characters, control codes for terminal output and, additionally, the option to change the attributes of the text such as brightness or color. The first available ANSI standard dates back to 1977 (ANSI, 1977). Both codes have been used for artistic purposes in various different domains, including the demoscene. Already the first computer artists in the 1960s experimented with character-

based expression, as documented by Franke (1971). Typewriter art can be considered as the conceptual predecessor of the digital experiments.

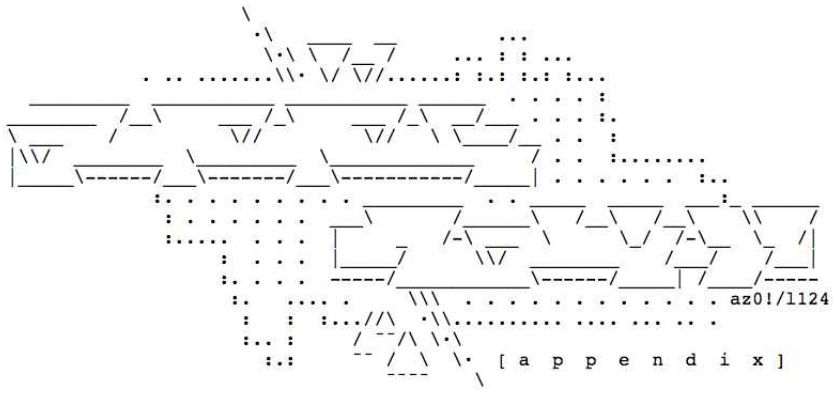

Figure 4.15: ASCII logo for Appendix

In the context of the demoscene, text logos have appeared as part of infofiles (see Fig. 4.15), ANSI/ASCII collections have been published, and there is even a long-standing competition for creating demos that display their visuals in text format (tAAt, 2002). The limitations of such output are obvious: the pixel and color resolution are extremely low (for example 80x50 characters with sixteen fixed colors). However, such limitations create a distinctive retro style and provide the programmers and graphic artists yet another opportunity to prove themselves by ingeniously overcoming the challeng.

4.4.4 Disc Cover Art

Decorating 5.25” diskette covers is an old form of visual art that was born in the Commodore 64 cracker and demo circles. What makes disc covers unique among the visual artifacts is their physical nature: they accompanied diskettes sent out by swappers and were photocopied again and again when they progressed in the swapping networks. The cover art was chiefly drawn by hand for the sake of quality, and the colorscale was limited to high-contrast black and white to accommodate the photocopy process. The electronic distribution of productions and the switch to smaller 3.5” diskettes eventually diminished the artform, although decorated labels were still made for some demos (Polgar, 2005, p.155) and voting diskettes used at parties. For an example of how the disc covers looked like, see Figure 4.16. More examples can be found in the *Freax Art Album* (Vigh & Polgar, 2006).

The themes and styles of disc cover art were analyzed briefly in the course of this study, based on the scene paper art collection of Jazzcat/Onslaught containing over 1600 works (mostly disc covers and voting sheets) as of 3 April 2009. Unfortunately, the collection cannot be accessed online any longer. Even a concise study like this reveals the great variety of disc cover art: while obvious adolescent themes like women, drinking and fantasy definitely

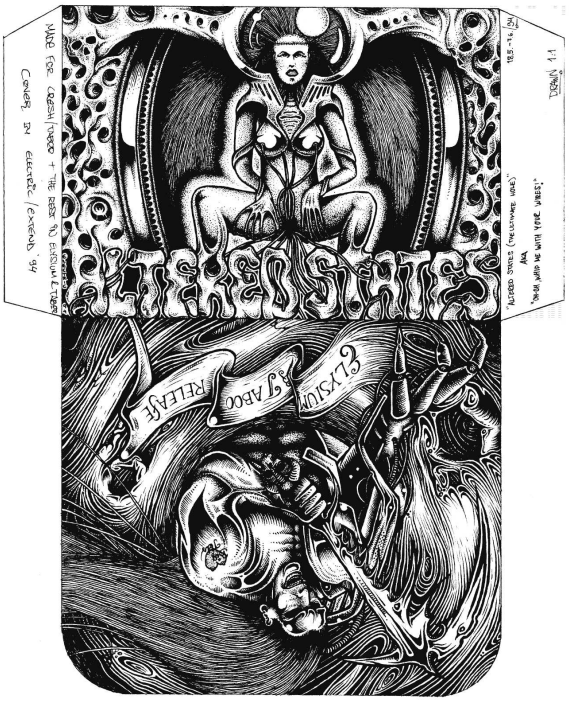

Figure 4.16: Disc cover art by Electric/Extend. Image from the collection of Jazzcat/Onslaught.

are present, it would be an oversimplification to discuss the art form solely on that basis. Visual references to different genres such as graffiti, comic book art (especially similar in its black and white expression), and even surrealism can be found in numerous works, and some of the authors have certainly developed a distinctive personal style. The fidelity of the covers varies notably as well, ranging from beginners' quick sketches to thought-out compositions.

4.5 Scene Music

Scene music is created for different purposes: demos, disk magazines, musicdisks, artpacks and competitions. Accordingly, the role of the music varies from a central artifact to mere background noise. As noted by Lönnblad (1998, p.14), a scene musician typically composes more music than the group can actually use in its productions. During its existence, scene music has changed significantly, reflecting both the technological and artistic currents of the time. Developments in hardware and software have provided for a widening scale of expression, and the emergence of new underground and mainstream musical styles (especially techno with its multiple subgenres) have given inspiration to the musicians. In this section, the main focus is on the technological side of things: how did each generation of hardware manifest itself in the demo music?

So far, among the most notable written works on demo music have been a master's thesis and a journal article by Lönnblad (1997, 1998). In her article, Lönnblad systematically analyzes the soundtracks of two well-known PC demos of the time, *Second Reality* by The Future Crew (1993) and *Caero* by Electromotive Force and Plant (1995), from a musicological point of view. The most central content is the side-by-side annotation of the music together with the demo effects. The master's thesis contains the same annotation plus the results of two surveys and a description of tracker software. Another published work, dealing with scene-related chip-music, was written by Carlsson (2008). Polgar (2005, pp.20–22) also provides some background information on the roots of the scene music in *Freax*. Some more, although surprisingly scarce, material was found in disk magazines (see Section 4.6). The sources specific to a certain type of music are discussed in their respective contexts below.

4.5.1 Chip Music

Chip music, also know as *chiptunes*, can be defined in two ways. By the first definition, it means music composed for the early home computers and their simple sound chips, hence the name. The second use of the term refers to both a musical style reminiscent of the old sound chips and the small size of the files, most typically modules (see 4.5.2 for the definition). A study on chip music in the context of computer and video games was written by Dittbrenner (2007) and published by the University of Osnabrück.

Technical limitations of the early sound chips, such as the low amount of channels (typically three), the lack of sample playback capability (partially overcome by CPU-intensive programming tricks), few waveforms and limited modulation capabilities produced a distinctive kind of sound. Carlsson (2008) describes some of the current retro activities revolving around chip music, such as artists producing music with old hardware. Other examples of related acts are *Desert Planet* and *PRESS PLAY ON TAPE* (Desert Planet, 2001; PPOT, 2001). The growing interest in 8-bit music has also given rise to websites such as the Commodore 64 music archive *The High Voltage SID Collection* (HVSC, 2000) and *chiptune.com*, and soundchip emulators like *Sidplay 2* that plays C-64 music (White, 2001).

On more capable platforms, chiptunes are created by using short looping samples, reminiscent of wavetable synthesis used in early synthesizers and sound chips. According to Carlsson (2008), chip music as a style emerged on the Amiga already in 1989. After that, chip music has frequently appeared in intros, musicdisks (also known as *chippacks*) and competitions. The popularity can partly be attributed to the distinctive sound carrying a reference to the early days of computing, and partly to the need to save space in 64k or 40k intros. Probably as big a factor is the mere challenge of keeping the music files tiny by using clever tricks, which can be taken as another case of limits embracing creativity, comparable to size-limited intros discussed in Section 4.2.

4.5.2 Modules

Modules, or alternatively *mods,* in the context of digital music can be defined as files containing both the score and the sample data needed for playing back a tune. The counterpart of a module is a *song*, which only contains the notes in order to save disk space: the samples are loaded separately when needed. Modules were the dominant kind of demo music and also a popular music format in computer games starting from the late 1980s, until new types such as MP3 and software synthesizers started to gain ground around the year 2000. Nowadays, modules still appear in competitions, musicdisks and demos, especially on platforms that have limited processing power or memory. As of May 2009, the *Amiga Music Preservation* project (AMP, 2002) lists close to 100,000 modules on their database, and according to the *ExoticA* project page, there are over 360,000 modules in the *Modland* archive (Lunder, 1996): figures that readily confirm the magnitude of the phenomenon.

Figure 4.17: ProTracker 2.3d (1994)

The fundamental concepts of a module are *patterns, tracks*, *rows*, *notes*, *instruments*, *effects* and *song order*. The editors used for creating modules were called *trackers*: Figure 4.17 depicts the user interface of *ProTracker 2.3d*, released in 1994 for the Amiga. Visible in the screenshot are the horizontally organized *tracks* and vertical *rows* (most often 64) that together constitute a *pattern*. On the rows and tracks the composer can place notes, instruments and effects. An *instrument* consists of a sample and additional information such as the volume, name, length and loop parameters. Various *effects* change the parameters of the music in real-time. Examples of the most common effects are vibrato, volume slide and arpeggio; a full list of the ProTracker effects with their descriptions can be found in *The ProTracker Guide* by Pedersen (2004). The overall structure of the tune is dictated by the *song order*, which is a list of pattern numbers to be played.

According to both Polgar (2005, pp.101–103) and Carlsson (2008) the first tracker was *The Ultimate SoundTracker* programmed by Karsten Obarski for the Amiga computers in 1987. The paradigm was soon accepted among the demoscene and extended by software such as *NoiseTracker* (1989), *StarTrekker* (1990) and *ProTracker* (1990), each of which added new features to the basic functionality. The availability of tracker source code let multiple groups build on the work done by others. For some years, trackers remained the sole property of Amiga users, but the appearance of affordable sound cards and the growing processing power eventually let PC compatibles play modules as well. The first trackers available for PC were *Scream Tracker 2* (1990), *MODEdit* (1991), *Whacker Tracker* (1992) and *FastTracker* (1992), all of them rather modest in comparison with their established Amiga counterparts. The introduction of *Scream Tracker 3* (1994) and *FastTracker 2* (1995) brought PC tools to a much more mature level. Both programs allowed the use of multiple tracks, far exceeding the four hardware channels available on the Amiga. Atari ST also had its own trackers such as *ST Soundtracker* (1990), *Esion XLI* (1991) and *Protracker ST v2.1* (1993).

The concept of a tracker became so deeply rooted in the demoscene that, even in the 2000s, new tracker programs have been created. Some examples of contemporary projects are *MilkyTracker* (2005), *ProTrekkr* (2008) and *Schism Tracker* (ca. 2004), a free reimplementation of the earlier *Impulse Tracker* from 1997. Modern-day trackers again extend the traditional tracker paradigm with features like filters and real-time sound synthesis. Even commercial trackers have been published at times: *Oktalyzer* (1988) and *DigiBooster Pro* (ca. 1997) for Amiga computers, and more recently the multiplatform digital audio workstation *Renoise* (2002).

4.5.3 Sample Music

The use of sample music in demos dates back to the 1980s. None of the early 8-bit home computers (Commodore 64, Sinclair ZX Spectrum, MSX Compatibles etc.) had hardware-assisted sample playback capability, which made digitized sounds such as speech a curiosity requiring clever programming and heavy CPU load in order to be implemented. C-64 ”digidemos” date back to at least 1985, when *General Demo* by The Professionals 2010 was released, according to the *pouet.net* database. Even the more powerful Atari ST line of computers, first available in 1985, did not have the feature before year 1989 when the STE model was released. However, thanks to its powerful CPU, the ST was significantly more capable of sample mixing and playing than its 8-bit contemporaries. The PC compatibles of the time had even more limited sound capabilities, but simple speech could be found already in the 1989 demo *Summer Holiday* made by The Sorcerers.

The appearance of the Amiga, with its four digital channels and trackers, changed demo music in the late 1980s (see Section 4.5.2 above). Technically, tracker music also consists

of samples, but the independently controllable channels and the possibility to effect and play the instruments at different pitches separate it from pre-rendered music. The high memory load of completely pre-rendered music was unacceptable at a time when the computers typically had only 512 kilobytes of memory. As an example, two minutes of 8-bit music played back at 22 kHz requires 2.5 megabytes of space.

Samples were reintroduced in demos in the 2000s by the arrival of lossy compressed file formats, MP3 and Ogg Vorbis. Early signs of the change were the MP3 competition held already at Assembly'99, and demos such as *State of Mind* by Bomb! (1998) and *Yume 2* by Inf (1998). At that time, the PC had become the dominant platform and the computational resources were very different to the 1980s. Tens of megabytes of available memory and CPU speeds in the order of magnitude of hundreds of MHz enabled the real-time decompression of lossy audio formats, ultimately diminishing the role of the modules. Because of the pre-rendering, any digital audio tool could be used for making demo music, which opened up new possibilities for expression and also brought scene practices closer to the conventions of commercial audio production.

4.5.4 Software Sound Synthesis

The increasing demands on 4k and 64k intros created the need to improve the music as well. All through the 1990s, music was actually banned in 4k intro competitions, sometimes justified by the claim that it should be a competition between programmers only (Assembly Organizing, 1998). From a technical standpoint, a chiptune module with a player routine is way too big for a 4k intro, and even with 64 kilobytes it's only possible to fit in very simple samples as instruments.

Software sound synthesizers (*soft synths*), also common in numerous commercial packages, became the preferred solution. The fundamental idea is to generate the waveforms and filters algorithmically in order to save space. The code still needs to be extremely tight, especially in the case of 4k intros. Some basic principles of tiny synthesizers are explained at the 4k intro-related site IN4K (2005). A more detailed series of 64k soft synth related articles called *The Workings of FR-08's Sound System* was written by Hinrichs (2001). The latter article describes the technical challenges with their solutions and additionally touches on an important topic: composing. A sound routine alone is not music. For more detailed discussion on different software sound synthesis methods, see the report by Tolonen et al. (1998).

4.6 Disk Magazines

Disk magazines (*diskmags*) can be described as scene journalism. The most defining properties when compared to other scene artifacts are interaction, collaboration and communication. A diskmag is an interactive application that contains articles about topics that are of interest to the community. The word ”diskmag” springs from the historical practice that such magazines were indeed distributed on physical diskettes when they first appeared in the late 1980s. Later on, other distribution channels such as BBSs and the Internet became common, and diskettes lost their importance, but the name still remained in use.

Disk magazines did not appear from nowhere: both Polgar (2005, p.49) and Jacobsson (2006) mention an earlier, paper-based cracker magazine called *Illegal* that was published starting from 1986. At first, the articles were in German only, but starting from 1987 also partly in English to serve the international audience. Illegal was the creation of Triad, an active cracking group at the time. A quick inspection of the first English issues (22–24) confirms that the magazine already shared several properties with the early diskmags: an editorial, news, charts and interviews. Other historical predecessors were the commercial disk magazines, most notably *Softdisk*, which appeared in 1981 for Apple II computers (Softdisk, 1995).

To publish an issue with over a hundred articles requires a collaborative effort of multiple persons. Typically a diskmag has a number of editors: an editor-in-chief coordinating all the efforts, and additional editors in charge of a specific section. Active readers submitting articles, news and ads to be published play an important role in the content creation. The efforts of programmers, graphic artists and musicians are required for the implementation of the interactive piece of software.

4.6.1 Selected Disk Magazines

The diskmags reviewed for this study are *Sex'n'Crime*, *Zine*, *R.A.W.*, *Imphobia* and *Hugi*. The selection is based on their perceived importance in various scene sources plus the timespan of the publication. The magazines cover the years from 1989 to 2008 and represent three different hardware platforms: the Commodore 64, the Amiga and the PC. Due to the MS-DOS–Windows migration of the PC scene, Hugi also represents two different software platforms. This section deals with the mentioned diskmags and their development during their lifespan.

Sex'n'Crime was a Commodore 64 diskmag that dealt with the demo and cracker scenes of 1989 and 1990. According to Jacobsson (2006), it was the first scene-related diskmag to exist. During two years, an impressive amount of 26 issues were published, which is more than once a month on average. The high count can be explained by the low amount

Figure 4.18: Sex'n'Crime #14 (1990) table of contents

of content: a typical issue contained only ten articles. The development between the first and the last magazines was not as radical as with other diskmags observed. Only the worst usability problems were fixed, while the format and the style remained almost unchanged (see Fig. 4.18 for an example).

> Kill Moskwa TV !!!!! He is l-a-m-e !!!! We from Amok declare war to everyone who swaps with Moskwa TV.

The first thing the reader notices when reading Sex'n'Crime is the hostile atmosphere of the scene, as exemplified by the above quote from the news section of Sex'n'Crime #07. Numerous articles and letters were dedicated solely to the constantly ongoing clashes between persons or groups, complete with appropriate accusations of lameness and stealing. The editors did not even try to calm down the discussion, but actively participated in the fights instead. According to the articles, the worst wars had even led to physical fighting at copyparties. Another instantly observable property was the still vague division between the pirate and the demo groups: crackers were listed on the same charts as the legal groups. In contrast with the other magazines reviewed, computer games received a high coverage (almost 10% of the articles). A more complete list of topics found in Sex'n'Crime can be found in Appendix C, Table C.1.

Zine represents the first generation of Amiga diskmags, spanning the years from 1989 to 1991. The geographical origins of Zine are highlighted by the fact that, in the first issues, some of the articles were still written in German. The distinction between crackers and demosceners was not yet well established, and the contents ranged from demo reviews to news of busted swappers. An exceptional property of Zine, when compared to other

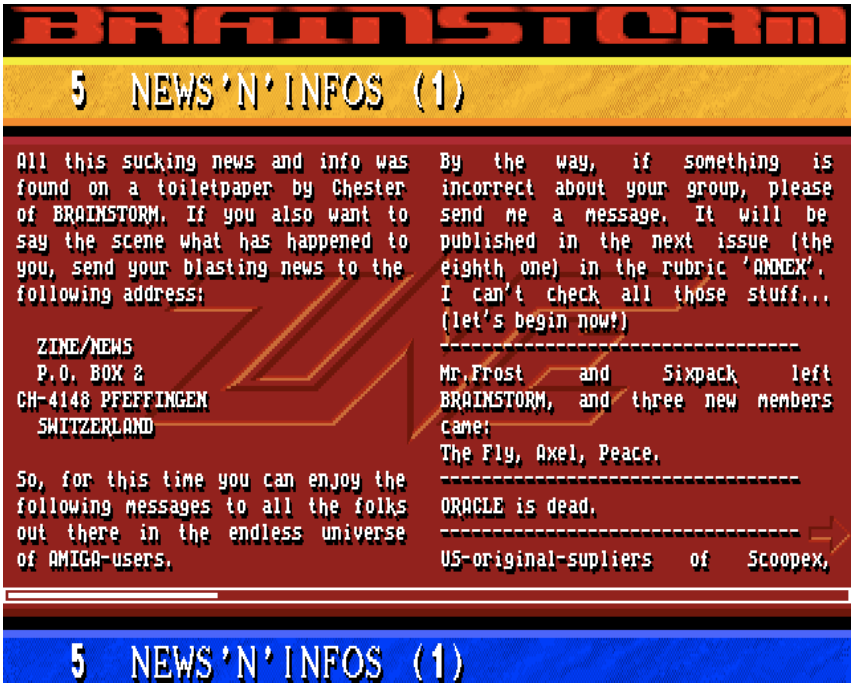

Figure 4.19: Zine #7 (1990) news page

magazines included in the study, was the focus on interviews: 14% of all the articles were interviews (see Table C.2 in Appendix C for a more detailed list of the topics). Graphically the magazine was mostly text-based and did not yet reach the visual sophistication of later Amiga publications of the early and mid-1990s, although the final issues already hinted at things to come with their improved layout and navigation. Figure 4.19 illustrates how the magazine looked like in the middle of its lifespan.

Already in Sex'n'Crime, contact advertisements had been an important part of the content. In Zine, even more so: the last issue (#11) sported as many as 34 pages of such ads, revolving around the theme of new swapping contacts. The wide geographical distribution of the ads serves as an example of the international nature of the demoscene already in its early days. Rather exceptionally, advertising was not free but there was a small charge involved. Even commercial ads could be found on the pages, although not in significant numbers.

R.A.W., the other Amiga diskmag examined, serves as a good example of how early simple magazines evolved into audiovisually rich and systematically edited publications. Figure 4.20, a screenshot from issue #2 (1992), already reveals a thought-out color scheme and a sophisticated user interface when compared to the earlier diskmags. A screenshot taken from R.A.W. #6 can be seen in Fig. 2.1.

R.A.W. was published from 1991 to 1996. The timespan coincides with the golden age of Amiga demos, and thus the articles reveal several facets of the development of that particular scene. Towards 1996, the large-scale migration to the PC became evident, which eventually led to the decline of R.A.W. A notable difference to early publications was the amount of

Figure 4.20: R.A.W. #2 news page

meta-level discussion on the scene, its practices and future (see Table C.3 in Appendix C). The amount of self-reflection indicates the growing consciousness of the community. No more was it just a hobby, but a phenomenon you were part of. The tone of the discussions was still highly controversial at times, as illustrated by the following excerpt written by *Captain James T. Kirk/Starship Enterprise Designs/TEK* in his article *Why Friendship Sucks* (R.A.W. #4):

> In today's demo scene there is no place for compromises, so do not bore others with your lameness, please. Work harder, or drop it. Friendship sucks!

Imphobia, published in 1992–1996, was among the most influential diskmags on the PC. The period was marked by the rise of the PC scene from obscurity to a major player. The same change was also reflected in the audiovisual quality of Imphobia: the first issues looked crude, but in two years the design had started catching up with the Amiga counterparts, obviously inspired by them. The main screen of issue 8, as seen in Figure 4.21, serves as an example of the development.

The amount of content in the magazine was overwhelming at times: the total number of articles peaked at 254 in the last issue published (Imphobia #12). Thematically, Imphobia resembled R.A.W. with some notable exceptions (see Table C.3 in Appendix C for a list of themes). The high visibility of parties (with 15% of all the articles categorized as directly related) reveals the growing importance of parties as forums for releasing new works. Another significant difference to R.A.W. is the high ratio of articles related to programming

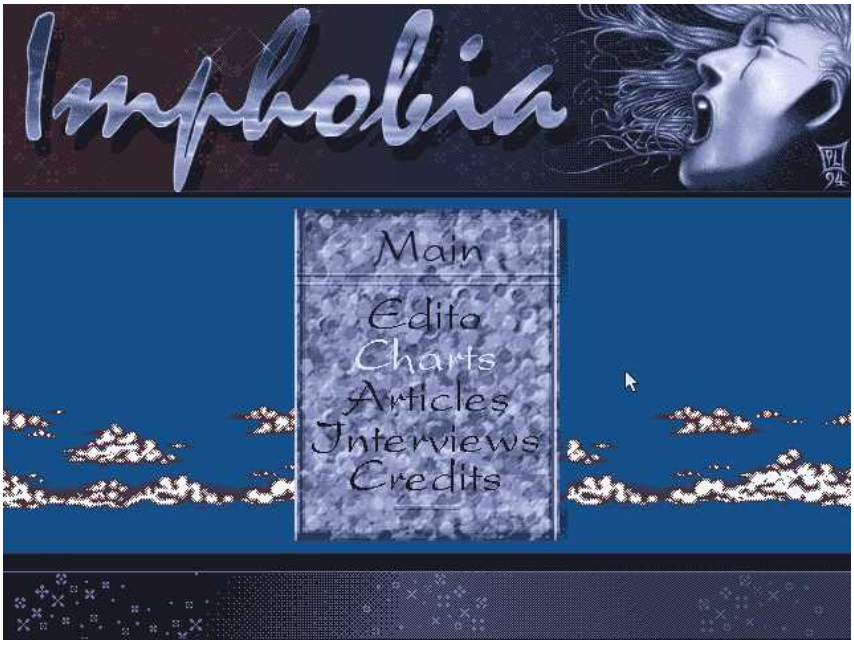

Figure 4.21: Imphobia #8 main screen

(6%). The growing self-consciousness of the community is clearly visible in Imphobia as well, especially towards the last issues.

Contemporary technological developments of the time were reflected in the contents: the Internet received some attention already in 1993, and in the last issues, the uncertain future of MS-DOS sparked speculation on the scene platforms to come. The attitudes towards Windows were chiefly negative at the time, and Linux was proposed as a possible alternative, together with a community-based operating system *Demo OS* (also referred to as *DemOS*) which never progressed beyond the planning stage (Imphobia #12).

Hugi is the newest magazine reviewed for this study. The first issue was published already in 1996 under the name *Hugendubelexpress*. At first, the diskmag was mainly written in German, but starting from issue 10 (1998) the articles started appearing predominantly in English. The German content is not considered in the statistics. The latest published issue, as of now, is from 2010.

During the twelve years of its existence, the magazine has seen two significant technological changes: the switch from MS-DOS to Windows and the growth of the Internet. The changes were reflected not only in the articles but also in the implementation of the magazine itself. The first issues published were MS-DOS only, and after a transitional period the diskmag become Windows-only in 1999 (#18). In the mid-1990s the attitudes towards Windows 95 were still mainly negative, with fears of being constrained by the slowness of the new system, but in the late 1990s the attitudes turned more favorable. The advent of the Internet is exemplified by the online version of Hugi, starting from issue 22 in 2001. The decline of the magazine, marked by the decreasing number of articles and yearly issues, in the

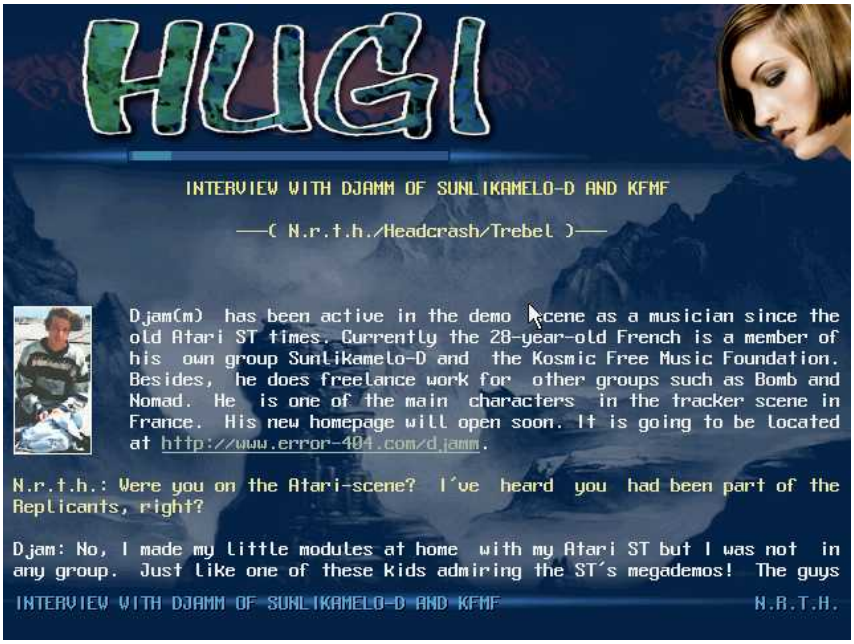

Figure 4.22: An interview in Hugi #15

2000s can be attributed to the growing importance of websites in the communication of the demoscene.

Visually Hugi continues the tradition of earlier diskmags, with only minor changes to the paradigm (see Fig. 4.22 for an example). An exceptional feature in the user interface is the addition of hyperlinks; an innovation most likely influenced by the Web. The themes do not stray far from the standards set by the earlier publications either (see Table C.5 in Appendix C). Some details do, however, stand out: the ratio of the content related to programming (almost 22%) is higher than in any other magazine of the study. The growing technical sophistication of demo effects is obvious in the programming articles, often discussing university-level mathematics and algorithms. Another peculiarity of Hugi is the exceptionally high number of articles about other diskmags.

4.6.2 Topics of Interest

To get a general overview of the themes of interest, the articles of the chosen diskmags were categorized according to their main topic, one theme for each article. Thus, the unit of analysis was an article. To cover the entire lifespan of each diskmag, issues were selected evenly from the whole range of years, unless it was possible to read all of them. Another parameter in the selection was the aim to cover the period of time from 1989 to 2009. The sum of individual issues examined was 54 and the number of articles examined was 2,957. The results by magazine are presented in Appendix C.

In order to study the phenomenon as a whole, the figures for each diskmag were normalized to counter the effect of different amount of issues and articles, after which the occurrences of each type were averaged between the magazines. The chosen method somewhat favors the magazines with a low article count, since after the normalization their weights are equal to the others. It is an acceptable skew, because otherwise *Imphobia* with its high article count and sampling would have dictated the results. The most popular themes stand markedly out as can be observed in Table 4.6.

Description	%	Description	%
editorial content	9.3	diskmag-related discussion	3.2
party invitation/report/results	9.3	humor	3.0
interview	8.4	presentation of / discussion about a person	2.4
scene meta-level discussion	8.4	game	2.4
news	6.7	presentation of / discussion about a group	2.1
programming	5.9	hardware/software	1.6
letter to the editor / response	5.1	story	1.6
review	4.8	politics	1.5
chart	4.5	swapping	1.4
ad	4.2	non-scene music	1.4

Table 4.6: The twenty most common types of articles found in disk magazines based on the number of articles

Obviously, each magazine needs to have some sort of editorial and since it is one of the few things in common with all of the publications it is rather natural that it should be among the top themes. The importance of parties can be anticipated as well, since the events are an integral part of the culture. Generally speaking, the relative number of party-related articles appears to grow over time: in the earliest issues, they were actually rather rare. The self-reflective nature of the community is again highlighted by the high amount of meta-level discussion of the scene, coupled with the comments sent by active readers. Interviews, news, charts and contact ads appear in practically all of the issues: they could be considered the bread and butter of the magazines, so to speak.

The high ranking of programming is somewhat surprising, since the C-64 and Amiga diskmags hardly discussed any programming tricks. However, in the PC magazines the topic was popular (see Tables C.4 and C.5 in Appendix C). Another unexpected finding is the relatively high amount of game-related articles: for example, in R.A.W. and Imphobia games seemed to be an almost banned topic. The occurrence can be attributed to Sex'n'Crime that frequently featured reviews of new computer games on its pages. Further discussion on the complicated relationship between the scene and games can be found in Section 3.3.3.

The study presented in this section should be considered as an initial attempt at categorizing disk magazines and their contents. The main goal, the creation of a general overview of the topics that have been of interest to the community, was fulfilled. However, numerous facets of the study should still be improved to obtain more reliable data. Firstly, the magazines

should be chosen so that they represent the timespan in question more evenly. While the amount of issues and articles examined is already high, it should be even higher in order to say anything conclusive about diskmags as a whole. Secondly, the simplistic approach taken in the categorization is not adequate in all respects. Is a review of a musicdisk a *review* or is it an *article about music*? In the future, a more detailed and flexible taxonomy should be devised to better accommodate such overlaps. Another property worth further consideration is the choice of the variables, since the number of articles alone tends to underemphasize, for example, news sections that might span tens of pages but only count as one article in the figures.

Chapter 5

Hardware and Software Platforms

This chapter deals with the different hardware platforms that have been popular among the demoscene. Software like operating systems and demo authoring tools are discussed briefly, since they are such a fundamental part of the equation. The aim is to make explicit the interplay of hardware and self-expression: how did the machines limit or support artistic aspirations, and how were the hardware properties visible in contemporary productions? Depending on the point of view, the scene has already existed during either three or four generations of microcomputer hardware, which in the context of technological development is a vast timespan.

For many years, the demoscene was largely focused on pushing the limits of the hardware. Even if early computers were not designed for things like real-time vector graphics or play-back of digitized sound, such feats were achieved to impress the community. An important factor was that roughly until the early 1990s, there was a deep uniformity inside platforms. For example, the Commodore 64, Atari ST and Amiga 500 were monolithic computers manufactured by one company only. Computers representing the same platform chiefly shared the same CPU speed, chipset features and system software. Such unity guaranteed compatibility and allowed the use of methods closely tied to hardware properties. Eventually ”hardware banging” was rendered unnecessary and impossible by the increasing level of abstraction in operating systems and the growing processing power, leading to system-friendly programming through standard APIs (Application Programming Interfaces) and detachment from the hardware details.

The line chart in Figure 5.1, published in an earlier article by Reunanen & Silvast (2009), depicts the relative popularities of different platforms at the four largest yearly demo parties (Assembly, The Gathering, The Party, and Mekka & Symposium) during the period of 1992–2002. This preliminary study reveals some interesting developments, most notably about the relative popularities of the Amiga and PC. In 1995 the two were practically even, after which the PC little by little started to take over as the dominant hardware platform. The

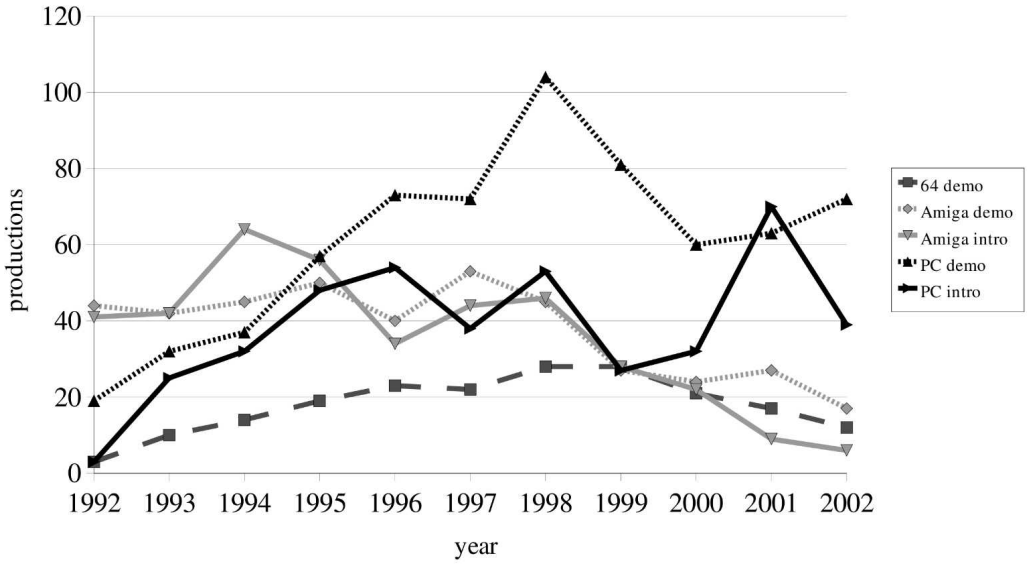

Figure 5.1: Productions at major parties 1992–2002 (Reunanen & Silvast, 2009)

bankruptcy of Commodore in 1994 and the increasing number of PC compatible computers appearing in homes are reflected in the chart as well. The increasing popularity of Commodore 64 is somewhat harder to explain: why would an aging home computer become more popular fifteen years after its introduction? Probable reasons for the phenomenon are the increased popularity of retro computing and the migration of active C-64 sceners to large mainstream Amiga/PC parties.

5.1 8-Bit Computers

The first 8-bit computers were hardly capable of any multimedia, but by the early 1980s, several computer manufacturers had already started mass producing models that could be used for games, which eventually allowed the demoscene to emerge, as argued in Section 3.1.1. The early 1980s home computer market was characterized by the great variety of mutually incompatible 8-bit machines built out of colorful plastic. Even the models made by the same company were not necessarily compatible with each other, as was the case with Commodore's *VIC-20* and *C-64*. Encouraged by the perceived market potential, a high number of electronics manufacturers entered the market, only to pull out a few years later.

8-bit computers were largely built out of off-the-shelf components—few companies had the will or capability to start designing processors or special chips—which made them technically close to each other. The main processing unit was typically Zilog's *Z80* (used in Amstrad CPC, MSX compatibles and Sinclair ZX Spectrum among others), MOS Technology's *6502* (used in Apple II, VIC-20 and Atari's 8-bit computers), or Motorola's *6809* (used in Dragon and TRS-80 computers). The processing power of each chip was somewhat

equal, even though Z80 ran at significantly higher clock speeds (3.5–4MHz) compared to 6502 or 6809 which typically operated at 1 MHz only. Common sound chips, such as the General Instrument/Yamaha manufactured *PSG (Programmable Sound Generator),* could produce three-channel audio with square waves. Sprite graphics were available on some models to support the hardware drawing of game objects. To keep the computers affordable the use of a TV set as monitor and audio tapes as storage media were common features. A comparison of the technical specifications of the most popular 8-bit home computers can be found in *The Encyclopedia of Game.Machines* (Forster, 2005, pp.202–203).

Video chips had somewhat more variety, but a fundamental property found in most of them was the characted-based nature of graphics generation. The screen consisted of a character matrix (for example, 40x25 on the Commodore 64 and 32x24 on the MSX compatibles) that contained indices to a character attribute table. Typical attributes of characters were its bitmap and foreground/background color. Initially the character attributes were reset to a readable font such as the ASCII table, but by changing the attributes, any kind of graphics could be produced. The base size for a character was commonly eight by eight pixels. A quick glance at almost any computer game or demo instantly reveals the character block locations on the screen. The color resolution was most often less than the bitmap resolution: for example, Sinclair ZX Spectrum only allowed two colors inside a character. Such a limitation led to a situation known as *color clash* or *bleeding*, where unwanted colors would show on objects because of their location. The ZX Spectrum graphics found in *Freax Art Album* (Vigh & Polgar, 2006, p.171–184) show how talented artists were able to circumvent the color clash by careful placement of objects, dithering and protective regions between characters.

Even though the 8-bits disappeared from the mass market around the year 1990, the demoscene still keeps making productions for them. *Pouet.net* reveals that in 2008 at least 124 demos or intros were released for the Commodore 64, 58 for ZX Spectrum, 18 for Atari XL/XE, 12 for Amstrad CPC, 5 for MSX compatibles and 4 for VIC-20. One significant reason why the 8-bit machines have been able to continue for so long are the various good-quality emulators available. Coupled with cross-development tools, emulators can be used for relatively easy software development for old hardware.

5.1.1 Commodore 64

The Commodore 64 was released in 1982 as a successor to the popular VIC-20. The aggressively priced and technically capable computer soon became a top seller both in the US and Europe. According to Bagnall (2005, p.303), at its peak in 1984 Commodore sold five thousand units a day. Forster (2005, p.62) estimates that the number of machines sold is around 20 million units, which is far beyond other comparable 8-bits such as the Amstrad CPC (2.5 million) and Sinclair ZX Spectrum (5 million). In 1985, Commodore revised the

product line with C-128 that contained Z80 for running CP/M programs, but its arrival was already being shadowed by the 32/16-bit generation. For more background history on C-64 and its marketing, see Bagnall (2005, pp.243–303).

The main processing unit of C-64 is MOS Technology's 6510, a slightly revised version of 6502, running at 1 MHz. As the computer's name suggests, there are 64 kilobytes of RAM available. The *VIC II* (Video Interface Chip) was advanced for its time, featuring sixteen colors, hardware scrolling and eight sprites. The graphics are based on the typical character generation paradigm with 40x25 characters, yielding 320x200 pixels in the two-color high-resolution mode and 160x200 in the multi-color mode. Many of the parameters of the video chip can be modified during the screen refresh to facilitate programming tricks, which gave C-64 an additional edge over its competitors. (Bauer, 1996) Also, the sound chip, *SID* (Sound Interface Device), was above average at its time with three channels, four waveforms, amplitude modulation and a hardware envelope generator. Especially advanced features, like ring modulation and programmable filtering, were absent from simpler sound chips. (Kubarth, 2006) The characteristic sound of SID still inspires musicians, as discussed in Section 4.5.1. For storage, C-64 used either cassettes or 5.25" floppies (the disc drive was sold separately).

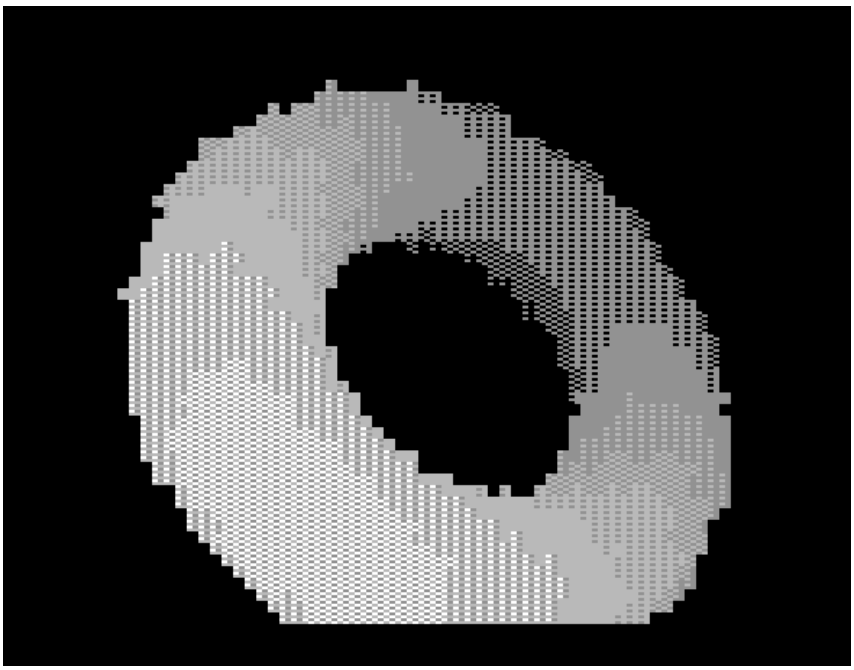

Figure 5.2: A shaded torus from *Mathematica* by Reflex (1995)

As discussed in Section 4.3.1, the first demo and crack intro effects were based on the properties of the hardware: colorbars, scrollers, moving sprites, writers and wobblers being among the most common ones. A completely different era started in the 1990s, when first the Amiga and later also PC demos started to feature advanced effects like vector graphics. The hardware of Commodore 64 is not suitable for polygonal graphics nor the real-time calculations involved, but the programmers did their best to bridge the gap. This game of

catch-up was played for several years, and feats such as texture mapping and shading were achieved by careful optimization, use of low blocky resolutions and precalculation (Fig. 5.2). Such devotion earned the C-64 programmers some reputation in the other scenes, observable in contemporary diskmag and newsgroup discussions, as exemplified by the following comments from Imphobia #5 (1993):

> It's amazing, what these guys get out of the C64, but I think that it's kinda foolish to keep programming such an old computer. (Rick Dangerous/Surprise!Productions)
>
> But no computer will ever beat the C64 in being explored and used even beyond its limit, I think. (Marvin/Sirius Cybernetics)

Copying effects from more powerful machines became an important, and still ongoing, trend in C-64 demos. Another direction was to create new hardware-assisted high-resolution effects and to improve old ones further. The modern C-64 demo style could be described as a mixture of the two trends. Design also made its way to the platform, and concept demos or carefully designed visuals can be found among the productions (the demoscene's concept of *design* is discussed in Section 4.3.2). The continuing popularity of the Commodore 64 is illustrated by the fact that in 2008 it still attracted notable demoscene interest with its at least 124 demos and intros. In contrast only 18 were released for the once-popular Amiga 500, according to *pouet.net*.

5.1.2 Less Popular 8-Bit Computers

Other 8-bit platforms, too, have their respective scenes, although significantly smaller than the C-64. According to *pouet.net,* demos have been systematically created for at least Amstrad CPC, Atari XL/XE, Commodore VIC-20, MSX compatibles, SAM Coupé, and Sinclair ZX Spectrum, most of which were among the best-selling machines of the time. Out of these six platforms, the ZX Spectrum has been the most active, despite its limited graphics capabilities. Almost all the game-capable 8-bit computers have attracted at least some demo-related activity. While Commodore 64 enjoyed wide international acclaim, the other machines were often popular only in certain countries, which is also reflected in their demoscenes.

The comparison written by Forster reveals the similarities and differences between the most popular 8-bit home computers. The MSX line of computers, released in 1983, is used here to represent a typical middle-ground home computer, not excellent nor abominable in comparison with its competitors. MSX is based on the Zilog *Z80* CPU running at 3.58 MHz and features 64 kilobytes of main memory in most configurations, even if the standard allows for less. A BASIC interpreter is stored in ROM and serves as the main user interface of the system as well. Graphics are character-based with 32x24 locations, yielding a maximum resolution of 256x192 pixels with 15 colors. The number of single-color sprites is as high

as 32, which was above average, since many video chips did not even support sprites at all. Audio is produced by the Yamaha *PSG* chip (AY-3-8910), which features three independent channels of square wave sound, volume control and simple envelopes. Out of the box MSX supports cassettes for data storage, but also a diskette drive was available as an add-on. (Forster, 2005, pp.202–203)

The demoscenes of the alternative 8-bit platforms mostly share the same properties as the C-64 scene described above. Early hardware pushing, the effect of more powerful platforms, and stylistic design experiments can be recognized, even if the scale is considerably smaller. At large demo parties, the Commodore 64 might still have a separate demo competition, but other classic machines have traditionally participated either in the wild or generic oldschool compos.

5.2 32/16-Bit Computers

The saturated home computer market, badly placed product lines, and Commodore's aggressive tactics forced most manufacturers to drop out of the game after the mid-1980s. The next generation was thus marked not only by the increasing computing power, but also the decreasing number of different platforms. The 8-bit MSX, released in 1983, was the first (although commercially unsuccessful) attempt to standardize components across different manufacturers, but it was not until the IBM PC clones' arrival in the mid-1980s that proprietary platforms controlled by a single company started to lose ground.

Traditionally, the hardware platforms following 8-bit computers have been called the *16-bit generation*. The name is rather misleading, since the Motorola *68000* CPU used in the Atari ST, Commodore Amiga, and Apple Macintosh actually has full 32-bit general-purpose registers and addressing modes, and only the data bus is 16 bits wide. Such naming is most likely used in order to gather the early PC compatibles (which were 16-bit) and other contemporaries under the same umbrella term, but here, the term 32/16-bit is used for the sake of exactness.

The shift from 8-bit to 32/16-bit machines meant that computing resources increased in numerous aspects. While 8-bit computers had typically had 64 kilobytes of main memory, the next generation sported at least 512 kilobytes: eight times as much. Processor speeds were increased to 7–8 MHz from the previous 1–4. CPUs like the 68000 had improved features missing from their 8-bit counterparts, such as 32-bit registers, hardware for multiplication/division and complex addressing modes (Motorola, 1992). Maximum pixel and color resolutions were improved, and in the domain of audio, the Commodore Amiga redefined the sound capabilities of home computers in 1985. Gone was the character-based generation of graphics: the new machines operated with bitplanes only, with the exception of the PC that also retained its text mode.

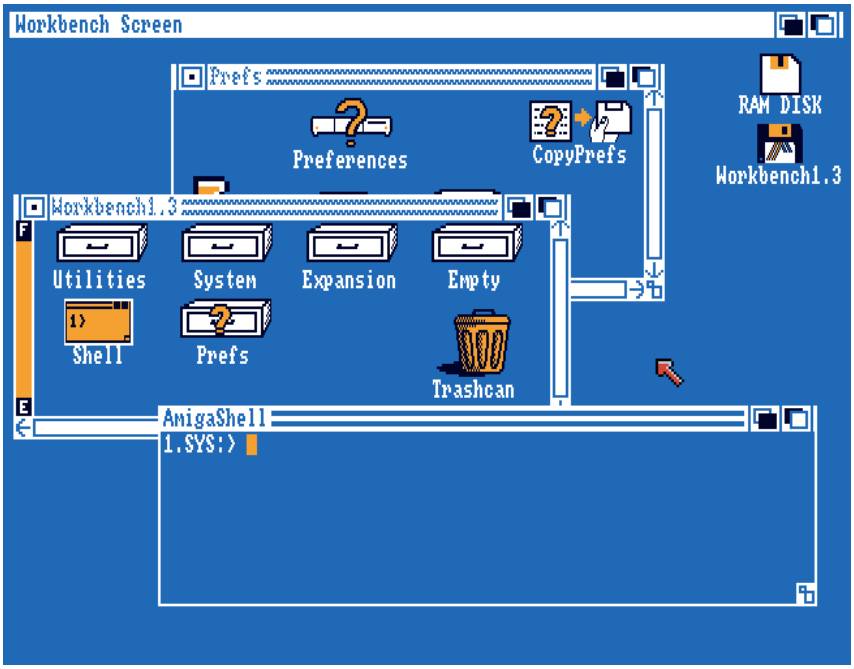

Figure 5.3: *Workbench 1.3*, the graphical user interface of the Amiga computers

The development affected software as much as hardware. The user interfaces of 32/16-bit computers were very different than the BASIC interpreter found on most 8-bit machines. Apple Lisa (followed by the popular *Macintosh*), Atari ST with its *GEM,* and Amiga with its *Workbench* all featured a mouse-based Graphical User Interface (GUI). Figure 5.3 is a screenshot of Workbench 1.3, the GUI of the Amiga computers. The familiar WIMP (Windows, Icons, Menus, Pointing) paradigm is recognizably similar to its more modern counterparts. For further discussion on the history of graphical user interfaces see Bagnall (2005, pp.416–417, 449–451), Johnson (1999), Lineback (2001), Myers (1998) and Manovich (2001, pp.63–115).

5.2.1 Commodore Amiga

The Commodore Amiga 1000, released in 1985, was an advanced multimedia machine for its time, featuring hardware capabilities not seen in other home computers. According to Bagnall (2005, pp.394–481) the machine, originally codenamed *Lorraine,* was designed as a powerful game console, which explains its audiovisual orientation. At one phase the project was funded by Atari, but ultimately it was Commodore who brought the final product to the market. While the Amiga 1000 and Amiga 2000 (1987) were well received, mainstream commercial success only started with the introduction of the cost-reduced *Amiga 500* released in 1987. A500 built on the success of the Commodore 64, being a convenient upgrade for the C-64 owning masses. Its general popularity and good multimedia capabilities made A500 the most important demo platform for a period of about six years.

The Amiga hardware is based on the parallel operation of the main processor and custom co-processors. The CPU is Motorola's 68000 running at 7.14 MHz and it shares the main memory with the custom chips. The original Amiga 1000 has only 256 kilobytes of memory, but A2000 and A500 feature 512 kilobytes. Media-wise, the most important co-processors are the *Blitter, Copper* and *Paula*. *Blitter* makes it possible to draw lines, fill areas and copy pixels from one location to another without burdening the main processor. *Copper* is another chip dealing with graphics, and executes its own list of simple instructions that enable the programmer to change various display properties in sync with the screen refresh. *Paula* deals with audio output, enabling the playback of four independent 8-bit sample channels in stereo with a frequency up to 28.8 kHz and 6-bit volume control. (Commodore-Amiga, 1991) The features of the audio chip led to, and are directly reflected on the *module* music format (Section 4.5.2).

Often-quoted graphics modes such as 320x256 with 32 colors and 640x512 interlaced with 16 colors (Forster, 2005, p.207) are only some of the possible modes available, since the number of bitplanes can be chosen from one to six in low-resolution modes and from one to four in high resolution. The whole area of the screen can directly be used for displaying graphics, by setting a wider or higher mode, meaning that the border area does not have any special importance like on other platforms. Other special hardware features also exist: *Extra Halfbrite* allowing the use of 64 colors in the low resolution modes, *HAM (Hold-and-Modify)* allowing the use of the whole palette of 4096 colors in the same time, and *Dual playfield* letting the graphics move on two independent layers, a feature useful for action games. (Commodore-Amiga, 1991)

Amiga demos of the 1980s mainly focused on numerous hardware tricks, and featured effects such as colorbars aka *copperbars*, various kinds of scrollers and moving sprites, not too far from the C-64 roots. Wireframe and flat-filled vectors appeared already in the eighties and were perfected in the early nineties with features like pattern filling and transparency. Fast vector graphics almost became an obsession, and the programmers competed with the amount of polygons that could be displayed at a steady 50 fps, also known as "in one frame". The so-called design demos (see Section 4.3.2) appeared halfway along the A500's lifecycle, increasing the audiovisual sophistication of demoscene productions considerably in the form of music sync, impressive still graphics, transitions between effects, and thought-out composition of visual elements.

5.2.2 Atari ST family

Atari entered the 32/16-bit home computer market rapidly with its *ST* line of computers in 1985 after losing the Amiga platform to Commodore. Different models such as the 520STM, which contained a TV modulator, and the 520STF with a built-in floppy drive, soon followed to offer features missing from the original version. The 1040ST line (1986)

was enhanced with a full megabyte of memory, and the STE models from 1989 introduced Amiga-like features, such as a blitter, a palette of 4096 colors (only 16 on-screen at a time), and sample playback hardware, to the consumer lineup. Atari also manufactured a more professionally-oriented product line known as the *Mega ST*. (Forster, 2005, pp.104–105)

520ST is the baseline Atari, based on the same Motorola 68000 processor as the Amiga, running at 8 MHz. The machine has 512 kilobytes of RAM and a 3.5" floppy drive for storage. Apart from the relatively powerful processor, the hardware is not highly suitable for arcade games: the sound chip is practically the same Yamaha *PSG* (YM2149) that was used in many 8-bit computers, there are neither hardware sprites nor a blitter, and the video chip can only display 16 different colors from a palette of 512. The basic graphics modes are the 320x200 pixel *lores* with 16 colors (four bitplanes), the 640x200 *medres* with 4 colors (two bitplanes), and the 640x400 two-color *hires* that requires a special monitor. The modest sound capabilities are somewhat compensated by the built-in MIDI ports that made Atari ST popular among musicians. (Forster, 2005, p.105, 206)

Figure 5.4: *Cuddly Demos* screen selector by The Carebears

The Atari ST demoscene was marked by its direct competition with the Amiga. The same war was fought in mainstream media: *which one is the best home computer* (Saarikoski, 2004, pp.136–137)? Apart from its faster CPU, the Atari ST was clearly in the underdog position with its modest graphics and sound hardware. Effects from the Amiga were mimicked and improved through ingenious programming tricks, but the flow was mostly one-way. Some specialties existed, however. The extensive use of interactive selection screens in Atari megademos is a property virtually unique to ST demos. Significant effort was invested in the selection screens alone: at times they contained game-like features (Fig. 5.4). In general, the amount of interactivity in demos is minimal, which makes the phe-

nomenon even more unusual. Another curiosity were the *reset demos* that appeared when the user pressed the reset button at the back of the computer. Atari megademos frequently featured parts from multiple groups, which is a rather uncommon feature in the scene as well. Atari ST demo history from 1987 to 1999 has been documented by Brandt (2000). In addition, three demo compilations have been produced in DVD format for easy viewing of Atari productions (Atariscene, 2005a,b, 2006).

Before leaving the home computer market in the 1990s, Atari released the last member of the ST family: the *Atari Falcon030* (1992). The machine contained several improvements over the STE line, such as better graphics modes (up to 640x480 in 16-bit color), a Motorola 68030 processor running at 16 MHz, a DSP chip for audio, and 4 MB of RAM in the basic configuration (Forster, 2005, p.105). Falcon faced harsh competition from the Amiga 1200, and the PC compatibles that had become a major player by that time, and it was soon withdrawn from the market when Atari decided to focus on its game consoles (*Atari Jaguar* was released in 1993). Despite its low sales, the Falcon, too, has attracted some demoscene attention, as exemplified by *pouet.net* which contains 652 productions for the platform.

5.2.3 Early PC Compatibles

The IBM PC first appeared in 1981, as the big iron company's attempt on the microcomputer market. The machine featured the Intel *8088* processor running at 4.77 MHz, 16 kilobytes of memory (expandable to 256), a 5.25" floppy drive and the *MDA* text display adapter or the *CGA* (Color Graphics Adapter). From a multimedia standpoint the PC was severely lacking and rather expensive too, costing $1565 at launch. IBM tried to fix the shortcomings by introducing the *PCjr* in 1983 with improved graphics and sound capabilities, but the machine did not sell well. The PCjr was also rather expensive with its $1300 price tag. (Forster, 2005; Polsson, 1995, p.99) In comparison, the Commodore 64 was initially sold at $595, in early 1983 already at $399 and finally, in mid-1983, at $200 (Bagnall, 2005, pp.293–294). The prices were brought down by inexpensive *PC clones* that started appearing shortly afterwards, and ultimately turned IBM into a minor player in the market it had created.

The PC has always been relatively strong CPU-wise. The IBM PC/AT (released in 1984) featured the fully 16-bit capable *80286* processor, roughly comparable to the Motorola chips of the time. The later Intel chips such as the 32-bit *80386* in 1985, and *80486* in 1989, kept the PC compatibles competitive with their rivals.

The expandability of the PC was a key factor when it slowly started becoming a multimedia capable platform. The original CGA was only capable of four colors at 320x200 pixels, but the *EGA* (Enhanced Graphics Adapter) introduced in 1984 could already display sixteen colors at resolutions up to 640x350, somewhat reminiscent of the Atari ST. Finally in 1987, the *VGA* (Video Graphics Array) was released, and brought the PC in line with the Amiga

computers in terms of color and pixel resolution, if not in power. VGA featured a maximum resolution of 640x480 pixels with sixteen colors and a lower resolution of 320x200 pixels with 256 colors. (Polsson, 1995) The latter mode was not based on the bitplane paradigm popular on the competing platforms, but a *chunky* framebuffer, where each byte corresponded to a pixel. Due to its enhanced visual quality and easy programming, VGA quickly established itself as the demoscene standard, and only few CGA or EGA demos were ever made.

The basic PC speaker sound was not suitable for games, and a number of sound cards started to emerge when PC clones became more popular at homes. *AdLib* set the standard for several years in 1987 with its FM synthesis, and was followed by the Creative Labs' *Sound Blaster* line in 1989. Sound Blaster retained AdLib compatibility and in addition provided one sound channel for 8-bit sample playback. *Gravis UltraSound,* capable of playing 32 independent 16-bit samples at the same time, was introduced in 1991. (Göhler, 2003) In addition to the expensive sound cards, some early PC demos also support home-made *Covox* clones, which are simple 8-bit D/A converters plugged into the parallel port.

Figure 5.5: *Second Reality* by Future Crew (1993)

The 1980s PC demoscene was small due to several reasons: the PC had not yet made its breakthrough as a home computer in Europe, games were scarce, multimedia capabilities modest, and there was no significant scene tradition on the platform yet. The situation started to improve in the early nineties, when PCs, too, got the capability of playing module music (Section 4.5.2), and the number of active groups increased. An often-mentioned milestone was *Second Reality,* a demo released in 1993 by the Future Crew (Fig. 5.5), which showed that PC productions could match the Amiga ones, although the level in general still was lower.

5.3 True 32-Bit Computers

32-bit computers became mainstream in the 1990s and their constantly growing performance left its mark in the demoscene. Processor speeds in excess of one hundred megahertz, megabytes of available RAM, hard drives, and improved data networks made microcomputers completely different to their 1980s' counterparts. IBM PC compatibles arrived in homes in increasing numbers, which eventually blurred the boundary between business and home computers. After Atari pulled out of the market and Commodore went bankrupt in 1994, the eighties' colorful variety of incompatible platforms finally disappeared from the mainstream computing and was replaced by industry standards. Operating systems saw equally radical changes in the nineties, when Windows 95 and NT, OS/2 and Linux emerged as alternatives to the aging MS-DOS.

Even before the disappearance of the two formerly big players, the era was already characterized by unification. In demos, chunky screens and effects rapidly replaced bitplane-oriented graphics, modules could be played on any platform with little overhead, and even the hardcore assembler programming gave way to effective C/C++ compilers. Ultimately, the demoscene had to give up its historical hardware pushing as well and start relying on industrial APIs. The level of abstraction increased and hardware properties had less importance, which on one hand directly contradicted with the traditional scene mentality, and on the other hand, let the authors focus more on the actual content. In the big picture, the developments emphasized the role of software in contrast to hardware, until 3D accelerators brought specialized graphics hardware back to focus.

5.3.1 Amiga 1200 and 4000

The *AGA* (Advanced Graphics Architecture) Amigas, *A4000* and *A1200* from 1992, were the last home computers released by Commodore before it filed for bankruptcy in 1994. At that time, harsh competition from the PC compatibles had already become apparent, and moreover, the new machines were not as exceptional as the Amiga 1000 had been in 1985. In 1992 the Amiga demoscene was still strong and especially the A1200 was well (if not unanimously) received as the next hardware platform that would let Amiga keep up with the PC hardware-wise. Several emotional diskmag and newsgroup discussions of the early 1990s revolved around the new machines and their potential future, as illustrated by the following quotes:

> Seriously, when and this is a definate WHEN a4000 demos will be released expect a lot of HOT demos... just think of what we can do with an 7Mhz Amiga.... and then *4 = one hot production... (Rat/Steel Design, alt.sys.amiga.demos, 1992)

> Some people even promised to code ONLY for AGA in the future (e.g. Laxity/Kefrens or Argon & Crash/Complex). Probably they want to be innovative and advanced – I call this stupidity! I bet you think, that in a year or two the whole scene has moved to the AGA standard, but I think you are completely wrong! (Rufferto/Covert Action Team, R.A.W. #6, 1993)
>
> In my opinion, competitions should always run on the best compatible standard configuration available, means on an A4000 at 25Mhz! (RokDaZone/INFECT, R.A.W. #7, 1994)

The Amiga 1200 was not a complete redesign, but rather an incremental upgrade to the existing consumer models. The sound capabilities remained practically the same, graphics were still bitmap-based, processor speed increased to a modest 14 MHz (fully 32-bit with Motorola *68020*) and the main memory grew to two megabytes. The machine also had an internal IDE controller for hard drives and a PCMCIA card slot for industry-standard expansion. Graphics modes were improved the most and the new AGA chipset could display 256 colors using eight bitplanes with a 24-bit palette. Maximum resolutions were improved too, up to 1280x512 pixels interlaced, but from a demoscene perspective such development was rather insignificant, since contemporary effects could not have been possible in real-time.

Commodore's last attempt, the *CD32* console, was released in 1993. After the bankruptcy, the assets were bounced from one company to another: *Escom*, *Gateway 2000* and finally a spin-off known as *Amiga Inc*. (Knight, 1997). Amigas could still be purchased at stores for some years, but no new models were being developed. In the mid-nineties, a 14 MHz CPU and two megabytes of memory were already outdated, but for several years, third-party companies such as *Phase 5* kept the hardware up-to-date by releasing turbo cards with Motorola's 680x0 processors up to *68060* and memory expansion sockets (Chapman, 1999). The accelerators became popular in the demoscene circles, and the Amiga productions made after the mid-1990s usually require one to run acceptably. Even PPC processor boards based on the Motorola *603/604* chips and 3D accelerated display adapters became available over time (Chapman, 1999).

PC and Amiga demos started to resemble each other in 1995 the latest. Big multiplatform parties, old Amiga groups moving to the PC, and similar hardware specifications can be recognized as some of the factors behind the development. Popular demo effects of the time, such as shaded vector objects, texture mapping, tunnels, various image distortions, and voxel landscapes were chunky by nature, meaning they were easier to implement on a byte-per-pixel display than on bitplanes, which gave the PC an advantage. On the Amiga, different solutions were tried to remedy the situation. Finally, a sufficient compromise between speed and resolution was devised in the form of *c2p* (chunky-to-planar) routines that converted a byte-per-pixel image to a planar one. The conversion was still a computationally demanding operation, which can be noted in the reduced resolutions and drawing areas

Figure 5.6: Two chunky-type effects from *Tint* by The Black Lotus (1996): a tunnel and a morphing environment-mapped vector object.

of contemporary demo screens (Fig. 5.6). Mikael Kalms, the author of one of the most known converters, has documented his approach and mathematical basis in detail (Kalms, 1997).

5.3.2 The Improving PC

It is problematic to discuss the PC compatibles as one hardware platform only, since a 1981 IBM PC shares very little with contemporary computers. A proprietary, business-oriented 16-bit computer has turned into a multi-purpose 32- or 64-bit multimedia platform with a great variety of manufacturers producing their own implementations. Software-wise ”the PC” is not a single entity either: MS-DOS was the dominant operating system in the PC demoscene until the late 1990s, at which point a viable alternative finally had to be chosen. In hindsight, it seems obvious that the scene would follow mainstream computing and eventually choose 32-bit Windows (95/98, NT and alike), but at the time, the choice was not as self-evident. Alternatives such as OS/2, BeOS, Linux, and even the community project *DemOS* were proposed and seriously discussed in diskmags and newsgroups. Initially, there was strong opposition against Microsoft that was seen as a monopoly producing slow and low-quality software that would not let the programmer control the machine any longer:

> And I can’t believe how the PC owners always do that what some companies (intel, microsoft) want: pay pay pay and get no adequate power. (FREAK, alt.sys.amiga.demos, 1994)
>
> The demo scene is a totally different world than all the microsoft business windows crap. (R. Eijkelhof, comp.sys.ibm.pc.demos, 1994)
>
> If someone starts to make Win95 demos, I dont have anything against it... But – please – don’t call it ’demoscene’. It would dishonourable. (Markus Aurala, comp.sys.ibm.pc.demos, 1996)

Positive attitudes can be found too, usually based on practical issues like improved demo compatibility and accessibility, which would keep the scene alive in the long run. OS/2 and BeOS never saw any significant demoscene activity, but Linux has attracted some programmers, and currently *pouet.net* contains 433 different productions for it, many of which multi-platform, i.e. available for other platforms as well. Conceptually, the Linux demoscene serves as a link to the free software and hacker cultures.

Hardware development in the 1990s followed the same incremental pattern that was apparent in the eighties already. Graphics modes were improved by the Super VGA (SVGA) cards, bringing high resolutions like 800x600 and 1024x768 pixels available to consumers and increasing the amount of colors to 16 and 24 bits (65,536 and 16.8 million colors). The aging ISA expansion bus was replaced by high-speed alternatives such as the *VESA local bus* (486 only), *PCI (Peripheral Component Interconnect),* and *AGP (Accelerated Graphics Port)* that allowed for significantly better throughput to the graphics adapter. The demoscene welcomed faster graphics, and since the mid-1990s several productions started supporting, or even requiring, graphics cards beyond the basic VGA standard. Processor speeds climbed from tens to hundreds of megahertz, with Intel Pentium being a notable milestone in 1993. The increasing processing power was not received unanimously, since it conflicted with the demoscene tradition of optimizing:

> Where does it stop then? If it goes on like this, the future demos will support pentium only (or run decently on a pentium)! I think the limit MUST be drawn by a 486DX33 for now and in the near future. If your demo runs smooth on a 486DX2-66 and not on a 486DX33 i advise you to quit coding and learn to optimize (or learn assembly ;)). (Scout/Success, comp.sys.ibm.pc.demos, 1994)

While the PC scene had played catch-up with Amiga until the mid-nineties, after that the situation was slowly reversed and it was the PC's turn to take the technical lead. Especially 3D vector graphics, well-suited for the hardware, received considerable attention. Texture, environment and bump mapped objects could be seen in numerous demos. The term *object show* refers to demos where 3D objects would be rotated on the screen without much other content. Another related concept is the *flyby*, a simulated flight in a vector world, again with little other content. The next revolution in demo graphics took place when affordable 3D accelerators became available in the late 1990s (discussed in Section 5.3.4). The availability of true-color graphics modes made demos more colorful than before and enabled the improved shading and blending of colors in effects. On the other hand, the improving pixel and color resolutions were not as suitable for completely hand-drawn graphics as the old low resolutions had been. The same phenomenon was taking place in the field of new media on a larger scale as well and pixeling started to be replaced by true-color photo editing and composition (Sections 4.3.2 and 4.4.1). An example of the late nineties' demo style is portrayed in Figure 5.7.

Figure 5.7: *Inside* by CNCD (1996): shaded texture mapping and an overlay with a popular culture reference

5.3.3 Other 32-bit Demo Platforms

Some other 32-bit platforms have received their share of demos as well. Rather interestingly, the Macintosh line of computers, often regarded as art and media oriented, has attracted little productions so far. The Macintosh has not been a significant platform for computer games either, which reflects its different use. However, the hardware differences (CPU family, external connectors and expansion cards), that once clearly separated the Mac and PC computers became less important after the year 2000 and practically disappeared in 2006, when Apple too moved to the Intel x86 processors. After that, the only meaningful difference has been the operating system. Observation of *pouet.net* reveals that it was only after the introduction of *Mac OS X* in 2001 that the demoscene became interested in the platform. The state of Macintosh demoscene five years ago was documented in the *Mac Life* magazine by (Beck, 2004).

The traditionally closed development model has hindered the attempts to create demos for game consoles. According to *pouet.net,* demos for popular platforms like Sony's *PlayStation 2*, Microsoft's *Xbox* line and Nintendo's *GameCube* or *Wii* are rare experiments as of now. Sega's *Dreamcast* has seen a little more activity, but nothing that could be called a full-blown demoscene. The most active contemporary consoles are the handhelds: Nintendo's *Game Boy Advance*, Sony's *PlayStation Portable* (Fig. 5.8), and the Korean open-source handheld *GP2X* each have a selection of tens of demos.

Other 32-bit platforms with demos are mobile phones and PDAs. They are usually based on the ARM line of RISC processors, common in many portable battery-operated devices.

Figure 5.8: *Suicide Barbie* by The Black Lotus running on PlayStation Portable

Mobile demos can be taken as just one platform experiment more, but their existence also hints at the professional lives of some of the community members, who most likely have ended up as developers in the large mobile hardware and software industry.

The increasing level of abstraction in software development has effectively hidden the underlying hardware and, in many cases, even the operating system. Such a trend can be observed in demoscene productions as well. While the demos of the eighties and early nineties were tied to the hardware and exploited it directly, API-oriented programming has largely detached demo programming from a particular platform. The existence of multi-platform productions, unimaginable in the eighties, proves the observation. Cross-platform APIs such as *OpenGL* (Woo et al., 1999) are available on Windows, Linux and Mac OS X, and thus it has become possible to recompile demos across platforms with comparably little extra effort. The web browser is another example of a hardware-neutral application platform, and demos written in *Java*, *JavaScript* or *Flash* are readily viewable on any modern computer with no extra porting effort.

5.3.4 3D Acceleration

The *Voodoo* line of graphics cards, released in 1996 by 3dfx Interactive, introduced accelerated 3D vector graphics to the mass market. Until that point 3D acceleration had practically been restricted to expensive professional equipment. Other contemporary contestants in the market were *Matrox* and *ATI*. A bit later, *Nvidia* joined the competition with its popular *Riva* and *GeForce* series. Demoscene productions continued to be software rendered until the end of the 1990s, when big parties like Assembly started to feature competitions allowing 3D acceleration (Assembly Organizing, 1999). Figure 5.9 is a screenshot of *Virhe,* an early accelerated demo from Assembly'99.

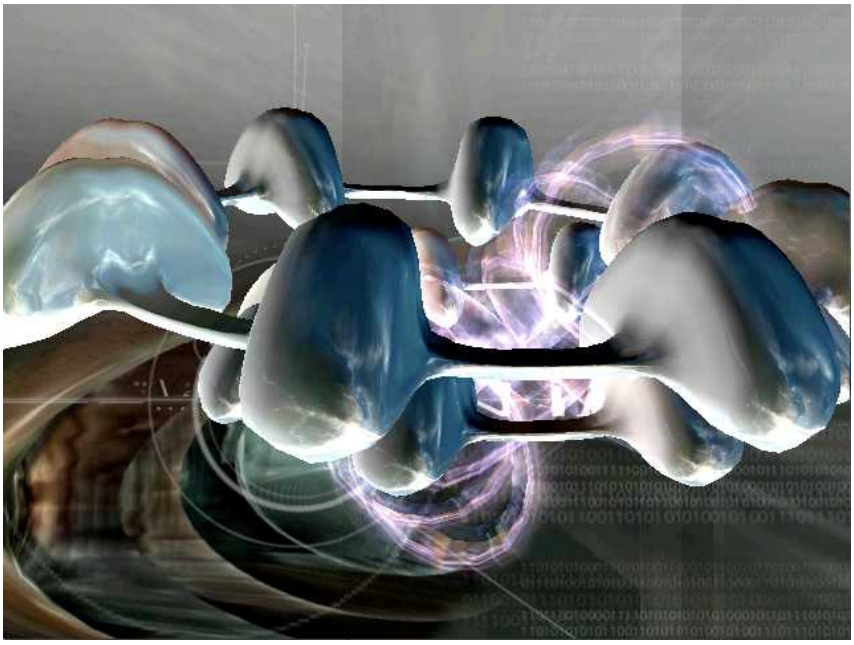

Figure 5.9: An early 3D demo using the Glide API: *Virhe* by MatureFurk (1999)

The migration to 3D accelerators was an important milestone on the path from low-level hacking to system-friendly programming. In practice, it was impossible to utilize the accelerator chips without using the vendor-provided API. The Voodoo cards featured their own proprietary *Glide* interface, but also *OpenGL* soon became popular, when it was adapted from the Silicon Graphics workstations to provide increased functionality and compatibility with professional graphics. OpenGL and its newer variants still remain the only low-level cross-platform 3D APIs, but their popularity has been somewhat shadowed by the wide use of Microsoft's *Direct 3D* in Windows and Xbox games. As of 2009, Windows demos are still released for both interfaces. Twenty of the demos listed in Appendix B are 3D accelerated.

From a programmer's point of view, the first accelerators not only offered new possibilities, but also set new limits. Improved resolutions, high polygon counts and good frame rates were the indisputably positive effects, but the fixed 3D pipeline (Woo et al., 1999, p.11) was rigid, and some flexibility was lost in contrast to software-based rendering. Individual pixels could no longer be controlled directly, and visual output had to be constructed of the few primitives offered by the API. The programmable pipeline only reappeared in the early 2000s in the form of *shaders* that let the programmer control the rendering process in more detail. Demo aesthetics did not change as rapidly as the technology did, and in practice, the first accelerated demos were like any other productions of the time, albeit with a high resolution and polygon count.

5.4 Roles of Software

Quite obviously, hardware alone does not constitute a platform. Various technically advanced, but commercially failed hardware designs found in the history of computing highlight the importance of application software—and marketing. So far we have discussed the role of hardware and operating systems in relation to the demoscene activities. Here the focus is on the concepts of authoring tools and algorithms: what kind of tools does demo making require? What kinds of connections exist between demo programming and science?

5.4.1 Tools

Software development tools are the essential foundation for demo production. The real-time nature of scene productions has, until recently, required the use of low-level programming languages to achieve sufficient performance. There are certain signs of change, such as the use of browser-based technologies (Section 5.3.3). The use of assembly language, in the form of machine language monitors and assemblers, was a common demoscene practice until the mid-1990s, reflecting also the aim to control the machine completely. The emergence of high-performance C/C++ compilers rapidly changed demo programming in the later half of the nineties. Once again the change of paradigm did not go completely without opposition, as illustrated by the comment of *Shadow Weaver* in *comp.sys.ibm.pc.demos* (1994):

> All the majorly cool ones always were coded in complete assembler for complete speed, if not almost ALL Amiga demos were in assembler. I think the most of the flames are coming from people that JUST DON'T KNOW assembly language well enough to do all the stuff in, so they stick to their C++ and figure it works well enough.

The so-called *demomakers* are interesting curiosities among demo development tools. With little or no programming experience, it is possible to put together a production with effects and music. Figure 5.10 is a screenshot of the *RSI Demomaker* for the Amiga from 1991. Seemingly, the purpose of demomakers is to make demo creating easy and accessible to anybody. However, in reality the situation is not as straightforward, since productions made with "too easy" tools are frequently frowned upon in the discussions. Taking shortcuts is not in line with the demoscene concepts of authorship, skill and control. The same phenomenon is illustrated by the low amount of Flash productions, even if the program itself would seem fit for creating demos at first sight:

> Anyway, flash demos are not real demos, at my opinion, except if they're made fully using a SWF ActionScript editor, since a real demo is a coder demo. (BadSector, pouet.net discussion "TEH FLASH DEMO - SCENE", 2002).

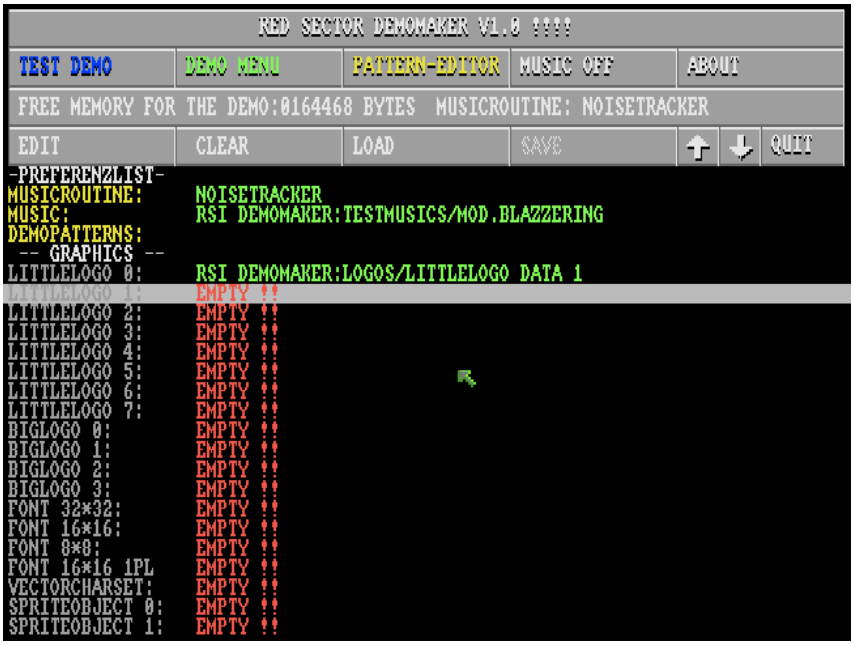

Figure 5.10: *RSI Demomaker* by Red Sector Inc. and TCC Design (1991)

The discussion thread ”Your Software for musicproductions, GFX, Coding is ?” (2007–2009) found on *pouet.net* with its 166 messages offers a general overview of the tools used in the most recent productions, even if not all the tools reported were used for strictly demo-related purposes. While such a sample is far from conclusive, some trends do appear. Table 5.1 contains the most frequently mentioned tools.

Category and Tool	#	Category and Tool	#
Programming		**2D Graphics**	
Visual Studio	48	Photoshop	38
GCC	36	GIMP	16
NASM	12	Deluxe Paint	8
Devpac	5	Paint Shop Pro	8
FASM	5	MS Paint	5
Music Tools		**3D Graphics**	
Renoise	19	Blender	14
Modplug Tracker	13	3ds Max	11
Reason	12	SoftImage XSI	3
MilkyTracker	11	LightWave	3
Ableton Live	11	Cinema 4D	3

Table 5.1: Popularity of demo-related authoring tools (2007–2009)

C/C++ compilers, such as *Visual Studio* and *GCC,* are the most common demo programming tools at the moment, due to the powerful code they generate. The GCC tool chain is often used as a cross-compiler for developing productions for exotic platforms, where it might be the only option available. Adobe’s popular *Photoshop* is equally popular among the demoscene, and its free alternative *GIMP* has found its user base as well. Rather in-

terestingly, the aging *Deluxe Paint,* popular in the nineties, is still used to some extent. 3D graphics are most commonly produced with the free *Blender,* and the commercial *3ds Max* that is widely used for realtime applications, such as video games. Other 3D packages mentioned represent commercial feature-rich software, comparable to 3ds Max. The strong tracker tradition of the scene is reflected in its music tools: three out of five most popular music applications are trackers. *Reason* is a professional sequencer, and *Ableton Live* a realtime DJ tool that can also be used as a sequencer.

If a suitable commercial tool does not exist one will be created. Perhaps the best examples of such activity are the various trackers that have existed since the late 1980s. The demoscene largely adopted the tracker paradigm, and since trackers, aside from few exceptions (see Section 4.5.2), were not commercially available, the solution was to program new ones. In addition, assemblers, executable compressors, and even complete paint programs have been created in the scope of demoscene activities, according to the demo tool list of *pouet.net*.

5.4.2 Algorithms

Demo-related programming does not fundamentally differ from any other software development, and thus the use of algorithms and data structures is part of the process. 3D graphics, sound programming and data compression are examples of advanced topics, requiring university-level knowledge of mathematics and software science. The focus on impressive audiovisual output, instead of factors like mathematical correctness, lets the programmer cut corners and use *ad hoc* solutions, as long as the end result appears interesting, but some topics are ultimately so complex that external reference material is required.

It appears that the connection between demos and science has grown stronger by time, when the complexity of effects has increased. Early effects such as scrollers, colorbars and moving sprites could be achieved with clever *ad hoc* programming and rudimentary trigonometry. The increasing popularity of 3D graphics in the nineties raised the bar, with topics such as transformation matrices, shading algorithms, texture mapping and depth sorting. Fractal-based graphics, most commonly *Mandelbrot* or *Julia* sets, can be found in numerous productions. Software sound synthesis (Section 4.5.4) involves various methods of signal processing. These examples propose that the scene is aware of many scientific findings that support its activities. At times, the links are even directly emphasized, as seen in Figure 5.11.

The diffusion of scientific knowledge inside the demoscene is a complex topic, so the discussion here is intentionally brief, especially since no interviews were conducted as part of the study. In general, it seems that new effects and techniques are first introduced by a few innovators, popularized by high-profile productions and then rapidly diffused to other groups, well in line with the diffusion of innovations theory by Rogers (2003). Forerunners function as mediators between the scene and the scientific world, and later adopters

Figure 5.11: *Dope* by Complex (1995)

learn about new methods in the context of the demoscene discourse. When compared to the diffusion process of new hardware and software platforms [see Section 5.5.1 and Reunanen & Silvast (2009)], new effects appear to diffuse painlessly with little or no opposition: platforms have traditionally been a source of constant controversy in diskmags and newsgroups, whereas new effects have mostly been embraced. One likely explanation to this phenomenon is that new effects and methods only serve as neutral *instruments* when trying to create impressive works, as opposed to platforms that engage the user on several levels.

5.5 Effects of Changing Technology

The demoscene has little influence on the constantly changing landscape of information technology. New hardware and software platforms are introduced each year, and existing ones eventually fade into obscurity. From a scene perspective, the changes appear external, uncontrollable and inevitable by nature. The community cannot affect such developments to any significant degree, but it can react to them through discussion and reinvention. At the other end of the scope, old productions and obsolete platforms constitute a large part of the history of the scene.

5.5.1 Patterns of Diffusion

As suggested by Turkle (1984, 1997) throughout her work, computers involve people on an intimate and personal level, serving as mirrors of the human spirit. Several discussions observed in the course of this study were marked by their highly emotional tone. Mere resistance to change is not a sufficient explanation to why new, seemingly beneficial innovations have been so fiercely opposed. After all, we are dealing with young proficient computer users that have few problems when learning to use new technology. It would seem that computers indeed operate beyond an instrumental level, and that an emotional bond is cre-

ated between the user and the machine. Suggesting that a platform should be abandoned directly violates the bond and calls for counteraction.

Despite the initial opposition, the demoscene eventually adapts to mainstream computing trends. The inconvenience of going with abandoned or alternative platforms is too high to be tolerated for an extended period. Sceners in general are not among the first adopters. As an example, the 32-bit Microsoft Windows did not become a widely accepted demo platform before the late 1990s, almost five years after its introduction. Demoscene practices had to be adapted to the new situation (no more direct hardware access), and the new platform had to offer something worth migrating (3D acceleration and a unified multimedia API). Another relevant factor was the increasing commercial pressure: new computers were not available with the old operating system any longer. Sceners, aside from being artists and enthusiasts, are consumers too. Seen from a utilitarian point of view, the skills acquired with MS-DOS were becoming obsolete in the working life, even though the importance of such a factor might actually be rather negligible in this context.

The general concepts of the diffusion of innovations theory (Rogers, 2003) can be applied to the demoscene's adoption processes. When a new hardware or software platform appears, the *innovators* try them out and release experimental productions, but the majority needs more time to adopt, as can be observed for example in the production catalog of *pouet.net*. It is only after the *opinion leaders* adapt that the new innovations start to gain momentum. High-profile productions, made by famous groups (*early adopters*) for a new platform, awaken the interest of the community, and when *critical mass* is achieved the majority will eventually follow. Some sceners will never adopt or require considerably more time, comparable to the *laggards* of the diffusion theory. Large parties, the most important channel for publishing new works, both reflect and set trends by allowing the use of new platforms in their competitions. As noted above and in Section 2.1.4, an innovation needs to be compatible with the community practices to ensure rapid adoption. Another factor in the process is the complexity of the innovation. For example, to switch from the Amiga 500 to the Amiga 1200 was a small step, but to switch from MS-DOS to Windows meant that completely new tools had to be learned. Such added complexity partly explains why the former migration took place with relative ease when compared to the latter.

Aune (1996) discusses the adoption process from a *domestication* standpoint: how do new technologies such as computers become parts of everyday life? Aune's third definition of domestication contains an interesting connection to the demoscene activities: "To tame or bring under control". The striving for control over the machine is a common theme in the scene discourse. The arrival of a new platform means loss of control and increased uncertainty, which can only be conquered by mastering the new tool. Another relevant observation made by Aune is that domestication happens on many levels (individual, household and society). Likewise, a demoscene member is part of a group and the community as a whole when making his personal decisions. The individual does not operate in a void, but

constructs his relationship to new technology through negotiation with others. The twofold process of adapting an artifact to already existing routines, and adjusting the routines to the artifact, can be observed in the demoscene as well. Intrestingly, Aune even mentions demos in her article, although she uses imprecise wording such as ”Amiga clubs” and ”game freaks” when referring to demo groups.

Another study from a domestication point of view was conducted by Lehtonen (2003), who used mobile phones and digital television as his case examples. Lehtonen claims that new technologies are domesticated little by little, through various knowledge-producing trials where both the user and the technology are tested (another example of influences going both ways). Rogers' straightforward diffusion model is contested, but overall, the article can be seen as part of the diffusion discourse with a different approach and terminology. Lehtonen, too, notes that from a user's perspective technology may appear uncontrollable, something that can only be reacted to. The concept of *warm experts*, used by Lehtonen, is well in line with the work of Aune (1996) and Rogers (2003): individuals seek help from their trusted peers when making decisions about adopting or discarding an innovation.

5.5.2 Digital Heritance of the Scene

The constantly changing hardware and software platforms pose a significant challenge to the accessibility of old demos. During the first two hardware generations the problem could be omitted, but now old software, computers and their accessories are increasingly becoming rarities. The original manufacturers like Commodore and Atari Computers are out of business, and even if they were not, supporting the old models would not be commercially viable. A notable property of the digital artifacts is their fragility: on one hand they can be infinitely copied but the loss of media, or even a small fraction of it, can make it impossible to successfully recover the artifact. *The Charter on the Preservation of the Digital Heritage* published by UNESCO (2003) recognizes the following challenges:

- Making digital heritage accessible
- Rapid obsolescence of hardware and software
- Lack of resources for preservation efforts
- Lack of preservation strategies and methods
- Inadequate legislation
- Low public awareness
- Creation of digital objects that last
- Selecting what should be preserved

- Ensuring the authenticity of digital heritage
- Preserving not only locally but globally
- Collaboration between the different stakeholders

By examining the list, it can be noticed that the challenges are not only technological or economical. The lack of strategies, methods, skills and awareness equally hinder the preservation efforts. While UNESCO's pamphlet is mostly concerned with governments, large institutions and companies, the principles have utility for the grassroots level as well. As an example of this Heinonen & Reunanen (2009) discuss the challenges faced by Finnish private collectors in relation to required national efforts.

Media art is a domain that has already been struck by the dilemma of rapidly aging hardware and software. Both Paul (2007) and Mark Tribe [as quoted by Wands (2006, p.206)], the founder of the pioneering net art community *rhizome.org*, have proposed similar measures to ensure the continuous availability of works of digital art: *migration* to newer platforms and *emulation* of old platforms on new ones. Tribe mentions the importance of *documentation* and the possibility of a complete *recreation* of a work. Although somewhat opposed to the idea (in fear of turning art institutions into "computer museums"), Paul also discusses the possibility of collecting old hardware and software to ensure continuity.

Preservation efforts of the demo community have been strikingly similar to the ones proposed above. *Emulation* is widely utilized to run old demos and, because of its already good accuracy and availability, even for developing software for aging platforms. The remarkable amount and quality of emulators can be attributed to the increasing worldwide popularity of retro phenomena. *Disk images* are conversions of physical diskettes into files, intended to be used with emulators and suitable for long-term archival. *Documentation* in the form of screen shots and descriptions takes place on various community websites (see 2.3). Demo archives preserve software and make it accessible to the community. It is becoming increasingly commonplace to make video captures of demos, which can be considered as a form of *migration*. Dedicated sites such as *capped.tv* and *demoscene.tv* offer the videos for online viewing. The popular *youtube.com* is also utilized for distribution. Some notable demo DVDs have been published to enable the viewing of classic works in good quality (Atariscene, 2005a,b, 2006; Demo or Die!, 2005a,b,c, 2006a,b; Digital Memories, 2006; MindCandy, 2002, 2006). Another form of migration is the porting of productions to other platforms, as discussed already in 5.3.3. Some productions have been fixed to run on improved hardware (a typical example being from Amiga 500 to the AGA Amigas). The complete *recreation* of demos is rare, because other forms of preservation have rendered the laborious task of recreation unnecessary.

Chapter 6

Conclusion

The study revealed a devoted community that continuously re-evaluates itself through discussion. Constant competition between groups and individuals has left its mark in many practices of the community. One could even say that recognition is the only currency of the scene. The great variety of artifacts became evident as well: several thousands of demos, intros of different types, pictures, tunes, disk magazines, group emblems, text files, and party-related items have been created during a time span of twenty-five years. The change in the audiovisual quality of demos was something that stood out when analyzing the artifacts. What started as single-screen intros with moving text later evolved into a complex form of media art, requiring years of learning to master.

Two main observations made about the relationship between technology and creativity are that the capabilities of the hardware have always been directly reflected in the works of scene art, and that the demoscene's aspirations have increasingly shifted towards self-expression from technically-oriented hardware pushing, when the tools available have allowed such development. Necessary tools have also been created by the community to fill in the gaps. Mastery of both hardware and software was a reoccurring theme: in accordance to its *mind over matter* mentality, the scene has encouraged its members to do the impossible and develop their personal skills further.

The most important contribution of this thesis is the broad overview of different topics related to the demoscene. While several other introductions to the phenomenon do exist, they have been brief and remained on the easily observable surface of the community. As such, the thesis serves as a stepping stone for researchers interested in demos: efforts can be focused on advanced topics instead of the trivial mapping of the domain. The different types of demoscene-related artifacts had not been documented in detail previously.

The study largely focused on the two content analyses. The analysis of disk magazines can be considered a unique approach. So far disk magazines have gone largely unnoticed by researchers, in spite of their rich content that sheds light on contemporary topics. Likewise,

the content analysis of demo effects—even if rudimentary—revealed clear trends that had only been estimated in earlier publications: what were the dominant effects of each era, how they reflected the capabilities of the hardware, and how they eventually disappeared after being made obsolete by new inventions. Even more connections could be made between demos and other domains in order to build a richer history of the events.

The breadth of the presentation does not come without problems. While the variety of topics covered is high, many important themes worth further attention had to be discussed briefly in only a few paragraphs. After constructing a general overview of the phenomenon the next logical step would be to study certain topics in depth. Some examples of such topics could be the composition of demo effects, the use of tools, or the diffusion of different innovations in the scope of the demoscene. Disk magazines still have more to offer and would constitute a worthy theme as well. A largely uncharted territory such as the demoscene would provide possibilities for many related fields of study, far beyond my own scope: youth culture or subculture research, art history, gender studies, and software science, to name just a few, could each provide their novel approach to the topic and add missing pieces to the puzzle.

References

Printed Publications

ANSI, 1977. *ANSI (American National Standards Institute) Standard X3.64–1977*.

ASA, 1963. *American Standard Code for Information Interchange*, *ASA X3.4–1963*.

Aune, M., 1996. The Computer in Everyday Life. Patterns of Domestication of a New Technology. In Lie, M. & Sørensen, K.H. (eds.), *Making Technology Our Own: Domesticating Technology into Everyday Life*. Scandinavian University Press, pp.91–120.

Bagnall, B., 2005. *On the Edge: The Spectacular Rise and Fall of Commodore*. Variant Press.

Barbat, N., 2005. You Can't Do This on Xbox! SHizZLE—Rumbling with 4 MHz. *SCEEN* #1, pp.42–44.

Beck, J., 2004. Lebenszeichen aus dem Untergrund: Mac-Demoscene. *Mac Life* 03.2004, pp.99–100.

Borzyskowski, G., 1996. The Hacker Demo Scene and Its Cultural Artifacts. Curtin University of Technology.

Botz, D., 2008. *Hacker-Ästhetik. Die geschichtlichen, technischen und gestalterischen Voraussetzungen zum Verständnis des Mediums Computerdemo (Hacker Aesthetics. Historical, technological and artistic premises of Computer Demos)*. Ludwig-Maximilians-Universität München, Institut für Kunstpädagogik. (Unpublished manuscript).

Brooks, F.P., 1975. *The Mythical Man-Month: Essays on Software Engineering*. Addison–Wesley.

Burger, B., Paulovic, O. & Hasan, M., 2002. Realtime Visualization Methods in the Demoscene. In *Proceedings of the Central European Seminar on Computer Graphics 2002*, pp.205–218.

Carlsson, A., 2008. Chip Music: Low-tech Data Music Sharing. In Collins, K. (ed.), *From Pac-Man to Pop Music*. Ashgate, pp.153–162.

Commodore-Amiga, 1991. *Amiga Hardware Reference Manual*. Third edition. Addison-Wesley.

Cruz, F., 2005. Mobile Mayhem. Demo Platforms of the 21st Century: Cell Phones. *SCEEN #1*, pp.52–56.

Dittbrenner, N., 2007. *Chip-Musik: Computer- und Videospielmusik von 1977–1994 (Chip Music: Computer and Video Game music from 1977 to 1994)*. Universität Osnabrück.

Faler, M., 2001. Johdatus demosceneen (Introduction to the Demoscene). In Sihvonen, T. (ed.), *Sähköä, Säpinää, Wapinaa: Risteilyjä teknologian kulttuurihistoriassa (Electricity, Action, Shaking: Cruises in the Cultural History of Technology)*. Turun yliopiston historian laitoksen julkaisuja nr. 59, Turun yliopisto (University of Turku), pp.7–23.

Forster, W., 2005. *The Encyclopedia of Game.Machines: Consoles, Handhelds & Home Computers 1972–2005*. Gameplan.

Franke, H.W., 1971. *Computer Graphics—Computer Art.* Phaidon Press.

Goryunova, O., 2007. *Art Platforms. The Constitution of Cultural and Artistic Currents on the Internet*. Media Lab, University of Art and Design Helsinki.

Grau, O. (ed.), 2007. *Media Art Histories*. MIT Press.

Haavisto, M., 2001. Diskmagit haastavat lukijan (Diskmags Challenge the Reader). *Enter* 7/2001, p.72.

Heinonen, M. & Reunanen, M., 2009. Preserving Our Digital Heritage: Experiences from the Pelikonepeijoonit Project. In *History of Nordic Computing 2*. Springer, pp.55–64.

Håpnes, T., 1996. Not in Their Machines. How Hackers Transform Computers into Subcultural Artefacts. In Lie, M. & Sørensen, K.H. (eds.), *Making Technology Our Own: Domesticating Technology into Everyday Life*. Scandinavian University Press, pp.121–150.

Inkinen, S. & Salmi, M., 1996. Media aseena ja työkaluna – hakkereita, teknohippejä ja koneromantiikkaa uuden median verkoissa (Media as a Weapon and a Tool—Hackers, Techno Hippies and Machine Romanticism in New Media Networks). In Tarkka, M., Hintikka, K.A. & Mäkelä, A. (eds.), *Johdatus uuteen mediaan (Introduction to New Media)*. Edita, pp.90–91.

Johnson, S.A., 1999. *Interface Culture.* Basic Books.

Kauppinen, J., 2005. Demoskenen alakulttuurista nousee suomalaisen it:n kärki (Top names of the Finnish IT Industry Rise from the Demoscene Subculture). *Aamulehti* 7 July, pp.20.

Krippendorff, K., 2004. *Content Analysis: An Introduction to Its Methodology*. Second Edition. Sage Publications.

Kurki, R., 2002. *WE ARE! Tutkimus postmodernista identiteetistä sukupuolittuneissa yhteisöissä (A Study on the Postmodern Identity in Gendered Communities).* Lahden ammattikorkeakoulu (Lahti Polytechnic).

Lehtonen, T-K., 2003. The Domestication of New Technologies as a Set of Trials. *Journal of Consumer Culture*, 3(3), pp. 363–385.

Levy, S., 1994. *Hackers.* Dell Publishing.

Lönnblad, H., 1997. Kahden tietokonedemon vertaileva analyysi (A Comparative Analysis of Two Computer Demos). *Musiikin Suunta (Musical Currents)*, 19(2), pp.28–34.

Lönnblad, H., 1998. *Tietokonedemot kulttuurina ja musiikin harrastuksen muotona (Computer Demos as Culture and a Form of Musical Hobby)*. University of Helsinki.

Manovich, L., 2001. *The Language of New Media*. MIT Press.

McLuhan, M., 1994. *Understanding Media: The Extensions of Man*. 1st MIT Press ed. MIT Press.

Motorola, 1992. *M68000 Family Programmer's Reference Manual*. Motorola.

Myers, B.A, 1998. A Brief History of Human-Computer Interaction Technology. *Interactions*, 5(2), pp. 44–54.

Nordli, H., 2001. From 'Spice Girls' to Cybergirls: The Role of Multimedia in the Construction of Young Girls' Fascination for and Interest in Computers. In van Lieshout, M., Egyedi, T. & Bijker, W. (eds.) *Social Learning Technologies. The introduction of multimedia in education*. Ashgate Publishing, pp.110–133.

Nordli, H., 2003a. *The Net Is not Enough: Searching for the Female Hacker.* Norwegian University of Science and Technology.

Nordli, H., 2003b. *The Gathering—Computer Parties as Means for Gender Inclusion*. IST-2000-26329 SIGIS, Deliverable Number D04.

Paul, C., 2007. The Myth of Immateriality: Presenting and Preserving New Media. In Grau, O. (ed.), *Media Art Histories*. MIT Press, pp.251–274.

Polgar, T., 2005. *Freax. The Brief History of the Demoscene.* Volume 1. CSW Verlag.

Rehn, A., 2004. The Politics of Contraband—The Honor Economies of the Warez Scene. *Journal of Socio-Economics*, 33, pp.359–374.

Reunanen, M. & Silvast, A., 2009. Demoscene Platforms: A Case Study on the Adoption of Home Computers. In *History of Nordic Computing 2*. Springer, pp.289–301.

Rogers, E.M., 2003. *Diffusion of Innovations*. 5th ed. Free Press.

Roininen, T., 1998. *Demoscene: että tietyt aineettomat arvot ja tavat yhdistävät joukkoa ihmisiä (Demoscene: That Certain Immaterial Values and Manners Unite a Group of People)*. Lapin yliopisto (University of Lapland).

Saarikoski, P., 2001a. Valtavirtaa vastaan – Demoscene suomalaisen kotimikroilun historiassa (Against the Mainstream—Demoscene in the History of Finnish Home Computers). *Lähikuva* 3/2001, pp.54–65.

Saarikoski, P., 2001b. *Pioneerien leluista kulutuselektroniikaksi. Suomalainen kotimikroharrastus tietotekniikan murroksessa 1980-luvun alusta 1990-luvun puoliväliin (From Pioneer Toys to Consumer Electronics. The Finnish Home Computer Hobby During the Computer Revolution from Early 1980s to Mid-1990s.).* Turun yliopisto (University of Turku).

Saarikoski, P., 2004. *Koneen lumo. Mikrotietokoneharrastus Suomessa 1970-luvulta 1990-luvun puoliväliin (The Lure of the Machine. Finnish Microcomputer Hobby from 1970s to mid-1990s)*. Nykykulttuurin tutkimuskeskuksen julkaisusarja, Jyväskylän yliopisto (University of Jyväskylä).

Saarikoski, P. & Suominen, J., 2009. Pelinautintoja, ohjelmointiharrastusta ja liiketoimintaa. Tietokoneharrastuksen ja peliteollisuuden suhde Suomessa toisen maailmansodan jälkeen (Enjoyment of Games, Hobbyist Programming and Business. The Relationship of Computer Hobbyism and the Game Industry in Finland after the Second World War). In Suominen, J., Koskimaa, R., Mäyrä, F. & Sotamaa, O. (eds.), *Pelitutkimuksen vuosikirja 2009 (Yearbook of Game Research 2009)*. Tampereen yliopisto (University of Tampere), pp.16–33.

Scholz, A., 2007a. Iconoclash. Opium for the masses. *SCEEN #2*, pp.50–56.

Scholz, A., 2007b. Teenyweenyfantastikum. A Whole World in a 4 kilobyte Nutshell. *SCEEN #2*, pp.72–75.

Scheib, V., Engell-Nielsen, T., Lehtinen, S., Haines, E. & Taylor, P., 2002. The Demo Scene. In *ACM SIGGRAPH 2002 Conference Abstracts and Applications*. ACM Press, pp.96–97.

Stamnes, B., 2004. Computer Parties. Case: The Gathering. In Tasajärvi, L. (ed.), Stamnes, B. & Schustin, M., *Demoscene: The Art of Real-Time*. Even Lake Studios & katastro.fi, pp.45–52.

Tasajärvi, L., 2003. demoskene.katastro.fi—The Exhibition. *Arsis,* 1/2003, p.9.

Tasajärvi, L. (ed.), Stamnes, B. & Schustin, M., 2004. *Demoscene: The Art of Real-Time*. Even Lake Studios & katastro.fi.

Thomas, D., 2003. *Hacker Culture.* University of Minnesota Press.

Tolonen, T., Välimäki, V. & Karjalainen, M., 1998. *Evaluation of Modern Sound Synthesis Methods*. Report 48. Helsinki University of Technology, Department of Electrical and Communications Engineering, Laboratory of Acoustics and Audio Signal Processing.

Tribe, M. & Jana, R., 2007. *New Media Art*. Taschen.

Turkle, S., 1984. *The Second Self: Computers and the Human Spirit*. Simon & Schuster.

Turkle, S., 1997. *Life on the Screen: Identity in the Age of the Internet*. First Touchstone edition. Touchstone.

Vigh, D. & Polgar, T., 2006. *Freax Art Album.* CSW Verlag.

Vuorinen, J., 2007. Ethical Codes in the Digital World: Comparisons of the Proprietary, the Open/Free and the Cracker System. *Ethics and Information Technology*, 9(1), pp.27–38.

Wands, B., 2006. *Art of the Digital Age.* Thames & Hudson.

Woo, M., Neider, J., Davis, T. & Shreiner, D., 1999. *OpenGL Programming Guide: The Official Guide to Learning OpenGL, Version 1.2*. Third Edition. Addison–Wesley.

Online Material

AMP, 2002. *Amiga Music Preservation – Home*. [Online] Available at: http://amp.dascene.net/ (updated 12 May 2009) [Accessed 28 May 2009].

Assembly Organizing, 1994. *ASSEMBLY '94*—THE THIRD PHASE. [Online] Available at: ftp://ftp.scene.org/pub/parties/1994/assembly94/info/asm-94.zip [Accessed 13 June 2009].

Assembly Organizing, 1998. *ASSEMBLY '98 OFFICIAL INVITATION TEXT*. [Online] Available at: ftp://ftp.scene.org/pub/parties/1998/assembly98/info/asm98inv.txt [Accessed 3 June 2009].

Assembly Organizing, 1999. *ASM99 >> COMPOS >> RESULTS*. [Online] Available at: ftp://ftp.scene.org/pub/parties/1999/assembly99/results.txt [Accessed 26 June 2009].

Assembly Organizing, 2006. *Demo Compos—Assembly*. [Online] Available at: http://www.assembly.org/2006/compos/realtime/demo [Accessed 13 June 2009].

Assembly Organizing, 2008. *Demo Compos—Assembly*. [Online] Available at: http://www.assembly.org/summer08/compos/realtime/demo [Accessed 13 June 2009].

Bauer, C., 1996. *The MOS 6567/6569 video controller (VIC-II) and its application in the Commodore 64*. [Online] Available at: http://www.cebix.net/VIC-Article.txt [Accessed 23 June 2009].

Beck, J. & Sobiraj, L., 2008. *The Demoscene and modern games*. [Online] Available at: http://zine.bitfellas.org/article.php?zine=13&id=19 [Accessed 2 June 2009].

Brandt, F., 2000. *Atari ST demo history*. [Online] Available at: http://www7.in.tum.de/~brandtf/ataridemos.html (updated in 2007) [Accessed 24 June 2009].

Breakpoint Organizing, 2009. Breakpoint 2009 – Everything Is Under Control. [Online] Available at: http://breakpoint.untergrund.net/ (updated 25 April 2009) [Accessed June 16 2009].

Chapman, I., 1999. *Big Book of Amiga Hardware*. [Online] Available at: http://www.bboah.com/ (updated 22 March 2009) [Accessed 25 June 2009].

Desert Planet, 2001. *Desertplanet.com – Videogame influenced electro-pop and space punk! Videopelihenkistä elektropoppia ja avaruuspunkkia*. [Online] Available at: http://www.desertplanet.com/ (Updated in 2009) [Accessed 27 May 2009].

Digitalcraft, 2002. *origami digital—Demos without restrictions*. [Online] Available at: http://www.digitalcraft.org/index.php?artikel_id=411 [Accessed 17 May 2009].

Edge Staff, 2008. *Inside the PS3 Demoscene*. [Online] Available at: http://www.edge-online.com/magazine/inside-ps3-demoscene [Accessed 1 June 2009].

Frappr, 2005. *Frappr Maps — My Maps — demoscene*. [Online] Available at: http://www.frappr.com/demoscene [Accessed 15 June 2009].

Geurtsen, D., 2000. *Disintegration of the Old Graphics Scene*. [Online] Available at: http://www.kameli.net/nocopy/disint.htm [Accessed 9 June 2009].

GFXZone, 2000. *GFXZone—the ultimate demo scene graphics site!* [Online] Available at: http://gfxzone.planet-d.net/ (updated in 2007) [Accessed 9 June 2009].

Google, 2001. *Google Groups*. [Online] Available at: http://groups.google.com/ (updated in 2009) [Accessed 29 May 2009].

Green, D., 1995. Demo or Die!. *Wired*, 3(7). [Online] Available at: *http://www.wired.com/wired/archive/3.07/democoders.html* [Accessed 18 May 2009].

Gruetzmacher, T., 2004. *PC Demoscene FAQ*. Plain text version 0.83. [Online] Available at: http://tomaes.32x.de/text/pcdemoscene_faq.txt (updated 16 June 2004) [Accessed 5 June 2009].

Göhler, S., 2003. *Phonomenal! ...a retrospective view on soundcard history*. [Online] Available at: http://www.crossfire-designs.de/index.php?lang=en&what=articles&name=showarticle.htm&article=soundcards (updated 30 September 2003) [Accessed 25 June 2009].

Hartmann, A., 2008. *"Type-Demos": Die Rolle der Schrift in der Demoscene (The Role of Writing in the Demoscene)*. [Online] Available at: http://www.4players.de/4players.php/download_start/Downloads/Download/50943.html [Accessed 15 June 2009].

Hinrichs, T., 2001. *The Workings of FR-08's Sound System*. [Online] Available at: http://www.kebby.org/articles/fr08snd1.html (updated 12 June 2007) [Accessed 3 June 2009].

HVSC Administration, 2000. *The High Voltage SID Collection (HVSC) – Commodore 64 music for the masses*. [Online] Available at: http://www.hvsc.c64.org/ (updated 1 May 2009) [Accessed 27 May 2009].

IN4K, 2005. *Main Page—IN4K*. [Online] Available at: http://in4k.untergrund.net/ (updated 9 October 2007) [Accessed 16 May 2009].

Jacobsson, P., 2006. Differentiate or Die. A study of the evolution of magazines in scene town. *Recollection* 1. [Online] Available at: http://www.atlantis-prophecy.org/recollection/?load=online&issue=0&sub=article&id=10 [Accessed 21 May 2009].

Kalms, M., 1997. *C2P Tutorial*. [Online] Available at: http://www.lysator.liu.se/~mikaelk/doc/c2ptut/ [Accessed 25 June 2009].

Kauppinen, J., 1991. *Finnish Scene-history, 1986 to 1991*. [Online] Available at: http://www.byterapers.scene.org/scene-sfscene86-91.htm [Accessed 16 June 2009].

Knight, G., 1997. *Amiga history guide*. [Online] Available at: http://www.amigahistory.co.uk/ahistory.html (updated 23 February 2003) [Accessed 25 June 2009].

Kubarth, D., 2006. *SID in-depth information site*. [Online] Available at: http://sid.kubarth.com/ (updated in 2008) [Accessed 23 June 2009].

Lamarre, T., 2004. An Introduction to Otaku Movement. *EnterText*, 4(1), pp.151–187. [Online] Available at: http://arts.brunel.ac.uk/gate/entertext/4_1/lamarre.pdf [Accessed 15 May 2009].

Leonard, J., 1994. *PC Demos Explained*. [Online] Available at: http://www.oldskool.org/demos/explained/explained/demos.html (updated 21 September 1998) [Accessed 5 June 2009].

Lineback, N., 2001. *Graphical User Interface Gallery.* [Online] Available at: http://toastytech.com/guis/ (updated 16 June 2009) [Accessed 23 June 2009].

Lunder, G., 1996. *ExoticA! Scenery Project.* [Online] Available at: http://www.exotica.org.uk/wiki/Scenery (updated 29 April 2009) [Accessed 28 May 2009].

McNicol, T., 2006. Meet the Geek Elite. *Wired*, 14(7). [Online] Available at: http://www.wired.com/wired/archive/14.07/posts.html?pg=5 [Accessed 16 May 2009].

The Mentor, 1986. The Conscience of a Hacker ("Hacker's Manifesto"). *Phrack*, 1(7). [Online] Available at: http://www.phrack.com/issues.html?issue=7&id=3#article [Accessed 5 June 2009].

Mitchell, A., 2005. *A Leet Primer*. [Online] Available at: http://www.technewsworld.com/story/47607.html [Accessed 17 June 2009].

Pedersen, H., 2004. *The Protracker Guide*. [Online] Available at: http://www.silent-dreams.de/handbook.html (updated 22 Jan 2008) [Accessed 28 May 2009].

Polsson, K., 1995. *Chronology of Personal Computers*. [Online] Available at: http://www.islandnet.com/~kpolsson/comphist/ (updated 24 March 2009) [Accessed 29 May 2009].

Press Play on Tape, 2001. *PRESS PLAY ON TAPE—The Commodore 64 Revival Band*. [Online] Available at: http://www.pressplayontape.com/ [Accessed 27 May 2009].

Pärssinen, M., Reunanen, M., Juntunen, I. & Isomäki, A., 1998. *No Copy?* [Online] Available at: http://www.kameli.net/nocopy/ (updated 7 January 2006) [Accessed 30 May 2009].

Raymond, E.S., 2003. *The Jargon File, version 4.4.7*. [Online] Available at: http://catb.org/jargon/ [Accessed 15 May 2009].

Raymond, E.S., 2006. *The Cathedral and the Bazaar.* [Online] Available at: http://catb.org/esr/writings/cathedral-bazaar/ [Accessed 15 May 2009].

Reunanen, M. & Silvast, A., 2004. *Demoscene Research*. [Online] Available at: http://www.kameli.net/demoresearch2/ (updated 3 April 2010) [Accessed 3 April 2010].

Scene.org, 2009. *scene.org—news*. [Online] Available at: http://www.scene.org/ [Accessed 21 May 2009].

Scott, J., 2003. *APPLE II CRACK SCREENS*. [Online] Available at: http://artscene.textfiles.com/intros/APPLEII/ (updated in 2008) [Accessed 17 June 2009].

Simmonds, A., 2001. Decoding Art. A Critical Analysis of the Demo Scene. [Online] Available at: http://www.hugi.scene.org/online/remix/hugi 23 - demoscene science ashton simmonds decoding art a critical analysis of the demo scene.htm [Accessed 18 June 2009].

Softdisk, 1995. *About us | Softdisk*. [Online] Available at: http://www.softdisk.com/about/ (updated in 2004) [Accessed 26 May 2009].

Szarafinski, S., 1955. *Tilburg 1995*. [Online] Available at: http://fms.komkon.org/MSX/Docs/Tilburg1995.txt [Accessed 17 June 2009].

tAAt, 2002. *Text Mode Demo Competition*. [Online] Available at: http://taat.fi/tmdc/ (updated November 2008) [Accessed 9 June 2009].

Ultra Force, 2007. *Ultra Force Development – Demogroup*. [Online] Available at: http://www.ultraforce.com/demogroup.php [Accessed 17 June 2009].

UNESCO, 2003. *Charter on the Preservation of the Digital Heritage*. [Online] Available at: http://portal.unesco.org/ci/en/ev.php-URL_ID=13367 [Accessed 15 May 2009].

Vigh, D., 2003. *Pixelstorm*. [Online] Available at: http://www.gr4ss.com/pixelstorm.html [Accessed 18 May 2009].

Volko, C-D., 2009. *Diskmags: Some of my articles about Diskmags*. [Online] http://www.students.meduniwien.ac.at/~n0102122/index_articles1.htm (alternative URL: http://www.hugi.scene.org/adok/) [Accessed 20 May 2009].

White, S., 2001. *SIDPLAY2 Home Page.* [Online] Available at: http://sidplay2.sourceforge.net/ (updated 12 June 2004) [Accessed 27 May 2009].

Research Material

CD-ROMs and DVDs

Atariscene 2003, 2005. [DVD] Dead Hackers Society.

Atariscene 2004, 2005. [DVD] Dead Hackers Society.

Atariscene 1985–1988, 2006. [DVD] Dead Hackers Society.

Digital Memories: The Best of Commodore 64, 2006. [DVD] CSW Verlag.

Demo or Die! Vol. 1., 2005a. [DVD] Abyss.

Demo or Die! Vol. 2., 2005b. [DVD] Abyss.

Demo or Die! Vol. 3., 2005c. [DVD] Abyss.

Demo or Die! Vol. 4., 2006a. [DVD] Abyss.

Demo or Die! Vol. 5., 2006b. [DVD] Abyss.

MindCandy Volume 1: PC Demos, 2002. [DVD] Fusecon.

MindCandy Volume 2: Amiga Demos, 2006. [DVD] Fusecon.

Shatz, P., 1993. *Walkthroughs and Flybys CD*. [CD-ROM] Waite Group Press.

Shatz, P., 1994. *Modeling the Dream CD. Walkthroughs and Flybys II*. [CD-ROM] Waite Group Press.

Disk Magazines

Hugi, 1998–2008. Issues #11, #15, #16, #19, #23, #27, #31 and #35. [Online] Available at: http://www.hugi.scene.org/fate.php?page=hugi [Accessed 21 May 2009].

Illegal, 1987–1988. Issues #22, #23, #24 and #30.

Imphobia, 1992–1996. Issues #1–#12.

R.A.W., 1991–1995. Issues #1–#9.

Sex'n'Crime, 1989–1990. Issues #1–#21.

Zine, 1989–1991. Issues #01, #02, #07 and #11.

Appendix A

Demo Content Analysis Form

Name:

Author(s) and roles:

Type:

Platform(s):

3D accelerated: yes/no

Year of publication:

Country/countries of origin:

Release party and ranking:

Parts and effects:

Music type:

References (popular culture, other demos etc.):

Other notes:

Appendix B

List of Demos Analyzed

Commodore 64

Omega Demo 3, Teeside Cracking Service, demo, 1985
Aliens, Scoop, demo, 1986
Infiltrator II, The 1001 Crew, crack intro, 1986
Judge Dredd, Triad, crack intro, 1986
The Soldiers, Radwar Enterprises, demo, 1986
Combat School, Fairlight, crack intro, 1987
Electric Cafe, Ash & Dave, demo, 1987
Graffiti, The Robots, demo, 1987
Phantom+, Beastie Boys, crack intro, 1987
Return of the Jedi+, Ikari, crack intro, 1988
Brainbuster, Eltronic, demo, 1989
Operation Thunderbolt, Optical, crack intro, 1990
St. Dragon+, Exodus, crack intro, 1990
Dutch Breeze, Blackmail, demo, 1991
Red Storm, Triad, demo, 1992
Seal of Focalor, Megastyle, demo, 1992
Tower Power, Camelot, demo, 1993
Torture 5, Padua, demo, 1994
Mathematica, Reflex, demo, 1995
Parts, Oxyron, demo, 1995
Unsound Minds (Follow the Sign 3), Byterapers, demo, 1996
Altered States 50%, Taboo, demo, 1997
Triage 3, Smash Designs, demo, 1998
Contact, The Ultimate Mayas, demo, 1999

Deus Ex Machina, Crest & Oxyron, demo, 2000
Edge of Disgrace, Booze Design, demo, 2008

Amiga

TechTech, Sodan & Magician 42, demo, 1987
Megademo, Scientific Cracking Team, demo, 1988
Red Sector Megademo, Red Sector Inc., demo, 1989
Budbrain Megademo, Budbrain Productions, demo, 1990
Mental Hangover, Scoopex, demo, 1990
Enigma, Phenomena, demo, 1991
Odyssey, Alcatraz, demo, 1991
Puuro, Complex, 40k intro, 1992
State of the Art, Spaceballs, demo, 1992
9 Fingers, Spaceballs, demo, 1993
Dream Trippin', Digital, demo, 1993
Full Moon, Virtual Dreams/Fairlight, demo, 1993
Falu Red Color, Razor 1911, 40k intro, 1994
Nexus 7, Andromeda, demo, 1994
Baygon, Melon Dezign, demo, 1995
Closer, CNCD, demo, 1995
Tint, The Black Lotus, demo, 1996
Phase, Phase Truce, 64k intro, 1997
Torque, Scoopex, 40k intro, 1998
Eraser Head, Floppy, 64k intro, 1999
Klone, DCS, demo, 1999
Gift, Potion, 64k intro, 2000
Lapsuus, Maturefurk, demo, 2001
Humus 3, Push Entertainment, 4k intro, 2002
Fistpig, Ephidrena & Spaceballs, 4k intro, 2003
Silkcut, The Black Lotus, 2004

Atari ST

README.PRG, The Exceptions, demo, 1987
The B.I.G. Demo, The Exceptions, demo/musicdisk, 1988
Cuddly Demos, The Carebears, demo, 1989
The Union Demo, The Union, demo, 1989
Galtan 6 Demo, Galtan 6, demo, 1990

Dark Side of the Spoon, Unlimited Matricks, demo, 1991
Grotesque, Omega, demo, 1992
Flip-O-Demo, Oxygene & Diamond Design, demo, 1993
Necrosys, Hemoroids, demo, 1994
Magique, Wildfire, demo, 1995
Reanimation, Syntax, demo, 1995
True Lies, Antic, demo, 1996
Lasse Reinbøng, The Naughty Bytes, 96k intro, 1997
Virtual Escape, Equinox, demo, 1999
Fantasia, Dune & Sector One, demo, 2003
Suretrip II – Dopecode, Checkpoint, demo, 2009

PC/MS-DOS

Summer Holiday, Sorcerers, demo, 1989
Megademo, The Space Pigs, demo, 1990
Cronologia, Cascada, demo, 1991
Dragnet, Dutch Computer Enterprise, demo, 1991
Vectordemo, UltraForce Development, demo, 1991
Amnesia, Renaissance, demo, 1992
Crystal Dream 2, Triton, demo, 1993
Plan-B, Sonic PC, 100k intro, 1993
Second Reality, Future Crew, demo, 1993
Show, Majic 12, demo, 1994
Animate, Schwartz, 4k intro, 1995
Dope, Complex, demo, 1995
Stars: Wonders of the World, NoooN, demo, 1995
Jade, Shock!, 64k intro, 1996
Megablast, Orange, demo, 1996
303, Acme, demo, 1997
Brighten the Corners, Valhalla, 64k intro, 1997
Poor guy!, Sunset Design & Procreation, 4k intro, 1997
te-2rb, TPOLM, demo, 1998
State of Mind, Bomb!, demo, 1998
The Fulcrum, Matrix, demo, 1998
Moral Hard Candy, Blasphemy, demo, 1999
Viagra, Mewlers, 64k intro, 1999
Heaven 7, Exceed, 64k intro, 2000
Tube, 3SC, 256B intro, 2001
Another Soul Lost, Traction, 4k intro, 2003

PC/Windows

Virhe, Maturefurk, demo, 1999
Mikrostrange, Haujobb, demo, 2000
604, AND & Sly & SynSUN, demo, 2001
Le Petit Prince, Kolor, demo, 2001
32 Degrees in the Shade, Yodel, demo, 2002
IV – Racer, The Lost Souls, demo, 2002
fr-025: The Popular Demo, Farbrausch, demo, 2003
Subversive, Bypass & Black Maiden, 64k intro, 2003
Arise, Stravaganza, demo, 2004
State of the Art 2004 Invitation, Equinox, 64k intro, 2004
195/95, Plastic, demo, 2005
Aether, mfx, demo, 2005
Fascination, Brainstorm & Traction, demo, 2006
Meet the Family, Fairlight, 64k intro, 2006
Lifeforce, ASD, demo, 2007
Candystall, Pittsburgh Stallers & Loonies, 4k intro, 2007
Germ, Atomic Destruction, 64k intro, 2007
Falling Down, UkScene Allstars, demo, 2008
Nazca, Cocoon, demo, 2008
Elevated, RGBA & TBC, 4k intro, 2009

Other

Your Song is Quiet, Inward & CyberPunks Unity, demo, 2007 (Spectrum)
Syntax Infinity, Traktor & Tulou, demo, 2009 (MSX2)

Appendix C

Themes of Disk Magazine Articles

Keyword	#	Keyword	#
news/rumors	57	interview	14
letter to the editor/reaction	29	movie	8
editorial	22	party/fair	7
ad	21	scene meta	5
chart	21	review	1
game	20	politics	1
		Total	**206**

Table C.1: Keywords of Sex'n'Crime articles

Keyword	#	Keyword	#
interview	30	drug	5
editorial	25	politics	5
scene meta	18	group	4
party/fair	17	diskmag	4
swapping	11	letter to the editor/reaction	4
review	10	philosophy/religion	4
humor	8	game	3
non-scene music	8	programming	3
ad	7	news	3
law enforcement	6	chart	3
hardware/software	6	other	23
		Total	**207**

Table C.2: Keywords of Zine articles

Keyword	#	Keyword	#
person	68	poll	11
scene meta	68	chart	9
editorial	56	swapping	7
humor	48	history	6
party/fair	41	politics	6
letter to the editor/reaction	40	programming	5
group	39	hardware/software	4
review	39	Internet	4
interview	36	literature	4
diskmag	18	movie	4
ad	14	real life	4
news/rumors	13	religion	4
non-scene music	12	other	32
		Total	**560**

Table C.3: Keywords of R.A.W. articles

Keyword	#	Keyword	#
party/fair	182	politics	24
scene meta	132	disk magazine	20
interview	85	humor	20
chart	84	real life	19
editorial	75	group	18
programming	72	Internet	16
ad	56	news	14
review	55	greetings	12
poem	52	game	11
hardware/software	36	non-scene music	11
story	35	design	10
scene music	32	UFO	10
graphics	30	swapping	6
letter to the editor/reaction	28	law enforcement	5
BBS	25	other	66
		Total	**1241**

Table C.4: Keywords of Imphobia articles

Keyword	#	Keyword	#
programming	172	hardware/software	13
party	102	politics	11
disk magazine	72	group	10
scene meta	63	news	9
editorial	61	Internet	7
interview	60	letter to the editor/reaction	7
review	59	humor	6
story	42	ad	5
chart	21	graphics	5
scene music	15	game	4
poem	14	other	39
		Total	**797**

Table C.5: Keywords of Hugi articles