Like City Lights, Receding: ANSi Artwork and the Digital Underground, 1985-2000

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ABSTRACT

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The rise of the Internet has obscured knowledge of the modes of mass online interaction that preceded it. Foremost amongst these was the Bulletin Board System (BBS), whose unique technological constraints encouraged the development of the art form known as ANSI. Through an examination of the economic paradigm shift that permitted mass adoption of microcomputers, the technological operating environment of the 1980s and 1990s and the ethos of the software piracy scene of that era, this thesis explains why this species of art took the form that it did, why artists chose to express themselves in this medium, and how ANSI defined the aesthetics of the online world between 1985 and the turn of the century. Far from a mere form of expression, the production and display of ANSI art on BBSes served as a signifier of and route to the acquisition of status within the *sub rosa* branch of autonomous dial-in computer systems that comprised the pre-Internet digital underground.

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and Cott Lang, Darkened Enmity and Tim Strike – none of whom I ever met,
but whose software made worlds and offered solace.

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Introduction

Silent Service BBS Logo by Eternal Darkness of Silicon Dream Artists (SDA), June 15, 1992. [1]

Objective

First Thoughts

From the perspective of the present, the commoditization of computer and networking technology has so profoundly affected the economic and social life of

[1] Eternal Darkness, "Silent Service BBS Logo," in *Silicon Dream Artists (SDA) Artpack '92* (Location Unknown: Silicon Dream Artists, 1992), http://artscene.textfiles.com/artpacks/1992/sda.zip (accessed May 4, 2009). To the best of my knowledge, the 1992 artpack was Silicon Dream Artists' only release.

advanced industrial societies that it is becoming difficult to imagine when this was not so. Driven by open networking standards on the one hand and the efficiencies of pervasive access to computing and communications resources on the other, the Internet has changed everything from the development of software to the ordering of pizza and the organization of protests. It is a unique, generative environment whose opportunities for creative expression and the enhancement of productivity through the wedding of software to the mass have provoked revolutions in all fields of human endeavour. The extent of its impact has been so great that the rise of the Internet has neatly divided the era of the information society from those that preceded it. In the process it has obscured the two decades of online interaction during which many of the schematic and technical mechanisms of current modes of user interaction with software, from usernames and passwords through to message boards, galleries and private e-mail, were developed.

For those whose formative years were during the transition period in which the barriers between the online and offline worlds weakened and vanished, the emergence of the Internet age has had the effect of nullifying or rendering irrelevant the memory of their interactions with the technologies, systems and communities that came before it. Though necessary to the purpose of repackaging the past into conceptually digestible and distinguishable units, the use of periodization in academic history represents an acknowledged interruption of the continuity of events.[2] Historians recognize that periodization is a conceptual lens that, like all lenses, presents the object of its focus in sharp detail while blurring all that lies before or beyond its focal point. It does some violence to the true past, but the purpose of its interference is meant to be therapeutic in

[2] See roundtable "Periodization: Then and Now," in *History Workshop Journal 63* (Spring, 2007): p.189-238.

that it is revelatory: used properly, periodization reveals at least as much – and arguably more – than it obscures.

Memory, which might be defined as the recollection of the past filtered through the mind of a population mass, is not nearly so forgiving.[3] Under the liberal aegis of contemporary academia, history engages in the reconstruction of the past under the sole and immutable assumption that the past should be understood for its own sake: the quest for knowledge of what is lost is teleological in that the accumulation of knowledge is held to be an objective good, an end in itself or by reference to the role it plays in some other overarching purpose. Subject to the unavoidable pragmatism of life in the present, which must balance the elemental scarcity of time against the infinite expanse of the knowable, memory seeks to retain useful knowledge – knowledge that provides advantage, power or meaning – while discarding that which is not. Much as the relevance of the knowledge of how to drive a team of horses is all but immaterial in an age of internal combustion, knowledge of the mechanisms, aesthetic and interactive forms, and structures of thought and sentiment that defined pre-Internet online communities are equally immaterial in an era of network persistence and pervasive Internetization.

Nostalgia has been described as "the longing for a never-was harbored by

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[3] Here I should like to draw a distinction between "public memory" and "the memory of the public," which I refer to simply as "memory." While both are organic in that they are fermentations of the mass, the former typically incorporates such sites or objects of commemoration as monuments, buildings, or personal artefacts, possesses an arguably explicit discursive purpose, and with the last is frequently the object of official notice or patronage. "The memory of the public" refers explicitly to the organic historical consciousness of the mass as it is developed and transmitted through informal mechanisms within specific social units (individual interactions with culture, family or community mythology, etc.). My definition here recalls analyses by Roy Rosenzweig and David Thelen, *The Presence of the Past: Popular Uses of History in American Life* (New York: Columbia University Press, 1998); and Alison Landsberg, *Prosthetic Memory: The Transformation of American Remembrance in the Age of Mass Culture* (New York: Columbia University Press, 2004). For a treatment of public memory, see Ronald Rudin, *Remembering and Forgetting in Acadie: A Historian's Journey Through Public Memory* (Toronto: University of Toronto Press, 2009).

someone in a never-is. . . a generalized envy for, and so glamorization of, an imagined time or condition."[4] In this, nostalgia represents a dual projection, specifically the recall of an idealized version of the past for the purposes of imposing upon it an idealized version of the self. Nostalgia works in one direction only, namely the imagination of what came before as somehow better than what exists at present. It is considered fallible, a "never was," because of the rose-tinting of recollection. But where nostalgia, memory and identity intersect is when the knowledge and values embedded in identity become desynchronized with the knowledge and values embedded in the historical consciousness of the mass. This produces a deeply individualized anomie, a feeling not that norms have been eroded *per se*, but that we have realized that the concurrence between what we know, believe and can make reference to through the problematic of imputed shared experience is less than it once was. Much as one feels choked when the material artefacts of memory are suddenly and catastrophically destroyed, as is the case with a house fire or the unintentional, unrecoverable deletion of sole copies of electronic data, the action of memory in discarding pasts that are no longer relevant evokes a species of nostalgia that is closer to loss.

When a physical community is lost through catastrophe, the shock of the event is sufficient to make it the subject of both immediate interest and historical enquiry. When it is winnowed or eroded through the workings of macro-level forces like changes in the means of production or the mode of consumption, scholarly history eventually seeks to capture this past as well. If a physically unbounded community dedicated to some particular purpose or notorious because of its acts dissolves, the crease in the fabric of

[4] Mark Kingwell, "Five Stops: Homesick and Wanting in the Blue Republic," in *Opening Gambits: Essays on Art and Philosophy* (Toronto: Key Porter Books, 2008), 146.

history left by its passing may well draw the eye of a future chronicler. But if a community does not exist in physical space, keeps no bureaucratic minutiae and, by virtue of its status as a *sub rosa* entity does not cause events to noticeably bob in its wake, there will be no reconstruction of its trajectory. Methodologically defined as it is by its reliance on the physical, be it in the form of documents or the detritus of events, academic history has proved inapt to the examination of self-organizing online communities. Despite appearances to the contrary, history and memory are united in their adhesion to their own definition of the practical: memory forgets what it believes it is not useful to know, and history rests on a platform of what it deems practically knowable.

This essay represents an attempt to resist the confining pragmatisms of both memory and history. In its desire to provide a published record of what memory has cast off, it will attempt to strike against the lossy present-mindedness of what is held to be relevant in the elusive now. In its bending of the rules of documentary investigation and its goal of reconstructing a form of social interaction that occupied no space and now exists primarily in the memory of its participants, it will seek to supersede the discursive formula of what history believes can be known. Finally, in its attempt to produce a memoir through the mode of analysis – for I, its author, lived and breathed the phenomena that shall be described here – it will stand as both a product of and an antidote to the nostalgia not of an idealized past, but of a past forgotten.

Art and the Digital Underground

Hackers, crackers, warez d00ds and couriers; users, systems operators, coders and moderators; lamers, phreaks and digital artists. All are archetypes of current online identities, and all draw their origins from the same source: the digital underground of the pre-Internet era. Riding the wave of the microcomputer revolution, archipelagos of discrete, self-contained online communities rose up in the sea of the public telephone network. The voice channel of a phone circuit could carry data between machines, and with that came all of the anonymizing and identity-masking effects of networked communications that are familiar now. The majority of these dial-in bulletin board (BBS) systems operated legitimately, frequently requiring real names of their users and authentication through callback verification. Beyond these, however, was a *sub rosa* branch of systems whose devotion to quasi-legal or illegal activities demanded that their users craft online personae distinct from their public selves behind the façade of the handle.[5]

Both the legitimate and illegitimate branches of the ecology of systems that comprised the pre-Internet online world arose because of the weakening or overcoming of identifiable economic, technological and social constraints. Similarly, the variety of roles played by each in serving the communities of users that patronized them was defined by either the modification of these constraints or, as is especially the case with examples of social constraint, the influence wielded over patterns of online behaviour by evolving archetypes of online identity and the establishment of identity- or community-derived norms unique to this operating environment. Much like any physical community, users of bulletin board systems came to define standards of behaviour, codes of conduct and discursive practices through their interactions with each other and the interplay between their community and the broader structures that sustained it. Many of these practises found their way into software, as was the case with the ways in which bulletin

[5] Also known, then as now, as a username, alias, or nick.

board operators sought to shape user behaviour through expedients like anonymization and post-to-call ratios. Within the permeable, evolving realm of what software would and would not allow, however, forms of expression peculiar to the medium, the constraints that governed it, and the identities of those who participated in it arose.[6]

The Form of the Interface I: "Paragon" menu prompt from Oblivion/2 BBS Software version 2.10, 1993. "59 Left" refers to how much time the user has left on the bulletin board. Because of the cost of their operation and their scarcity vis-a-vis the size of the population of users who accessed them, users were given a daily allowance of time to use the system.[7]

Many of these forms are familiar to the present. Bulletin boards were computer-based conversation systems that typically provided their callers with private email between users, public messaging, file transfers, and access to third-party programs ("doorgames"). These are all functions that persist now, and the data that flows through them is scarcely different. But if one looks at the presentation of these functions, examining the aesthetic of user interface over the access it enabled, a new form of expression appears: that of the system itself. This is the way in which software appears to users, and it is a phenomenon referable to an identifiable set of historical influences. Its natural limits are defined by the computing paradigm within which online interaction takes place and the broader forces responsible for the rise of that paradigm. In 2010, the graphics and multimedia-intensive aesthetic of the online world is defined by a cluster of mature, commoditized technologies, namely high-resolution displays, graphical user interfaces, megabyte-plus connectivity, and the superabundance of processing power that ties them all together. In 1990, the limits of the form were defined by text-mode

[6] "Permeable" because the limitations inherent in any one software package tend to encourage other developers to write new software in an attempt to overcome the limitations of the old.
[7] "Paragon Menu Prompt," in *Oblivion/2 BBS Software version 2.10* (Location Unknown: Darkflame Enterprises, 1993), http://cd.textfiles.com/somuch/smsharew3/MODEM/OBV2-210.ZIP (accessed March 14, 2009).

graphics, keyboard-driven interfaces, and connection speeds measured in tens of kilo*bits*. As a result, the online systems of this period had both a distinctly different visual aesthetic and interactive "feel" than their contemporary counterparts.

While the definition of what qualifies as art has expanded tremendously over the past century, computer interfaces are only gradually moving out of the periphery of what qualifies as acceptable subjects of criticism or historical analysis.[8] The study of interface design is driven by the corporations that are the largest users and marketers of computer technology, and designs are evaluated in terms of their efficiency, comprehensibility, and ability to promote a brand. Academic literature that addresses computer interfaces as has only recently come into its own, a fact that is surprising given that the encouragement of sentiment through the arrangement of *software* elements – art by any other name – is explicitly referenced in interface design through the nebulous category of "user experience." It becomes doubly surprising when one notes the decades-old art world fetish for "interactive" works and the oceans of ink that have been spilt in discussing the aesthetics and historical influences of noted industrial designers. The ties of sentiment that spring up between users and the fictional characters of video games are the same as those that appear amongst readers of literature. An implementation of an algorithm in software, specifically the arrangement of the elements that comprise a given routine, may produce an emotional response from the programmer that implements or reviews the code. Users are often attracted or repulsed not merely by the functionality of software, but by the design of its interface. The relationship between the arrangement of form and the feeling it evokes makes interface a species of art – but the silence of scholarly

[8] See Lev Manovich, "Post-Media Aesthetics," in *disLOCATIONS*, ed. ZKM (Karlsruhe: ZKM, Center for Art and Media/Center for Interactive Cinema Research, University of New South Wales, 2001) and Lev Manovich, *The Language of New Media* (Cambridge, MA: The MIT Press, 2001).

literature on the subject suggests that this categorization is not shared by many commentators.

History is the arrangement of selected facts into a narrative that seeks to expose and explain past events. Historians ask *why things happened the way they did*, and they answer this question by placing events within a causal framework that relates them back to the forces responsible for their occurrence.[9] Works of art are salubrious to the study of history not merely because the meaning of their expression is rooted in a specific period and set circumstances, but also because the form in which they are expressed represents a framework through which broader material social and economic constraints can be exposed. The impact of romanticism on modern conceptions of art and the lionization of the role of the artist-creator resulted in the popular belief that the major limiting factor on artistic expression is the unbridled imagination of the artist himself, but this is not strictly true. Instead, the first-order constraints that govern the creation of art and the form it takes are the availability of materials and the ways in which these materials can be arranged to produce meaning.[10]

While it must be acknowledged that deterministic materialism is not the sum and total in the explanation of the adoption of forms of expression, it must equally be recognized that material conditions play a significant and definable role in the development of these forms. To cite an example, the rise of a paradigm of painting through the use of siccative oil and mineral-based pigments would not have occurred absent the discovery and economic viability of the technique. To cite another, the

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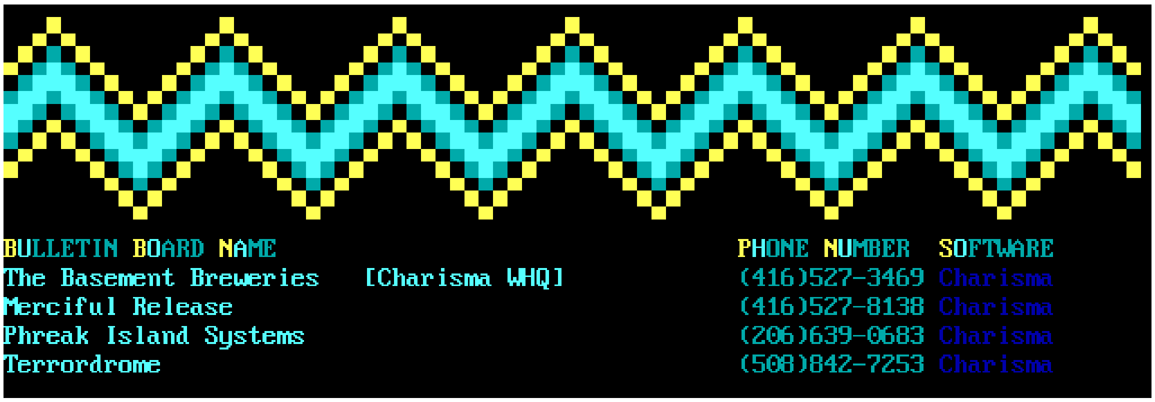
[9] E. H. Carr, *What is History?* (London: Macmillan, 1961).

[10] See Michael Hatt and Charlotte Klonk, *Art History: A Critical Introduction to Its Methods* (Manchester, UK: Manchester University Press), 37: "What gives art its characteristic forms in each age is that such individuals worked within a precise set of technical and social constraints – for instance, the artistic materials at their disposal, contemporary commercial practices and the requirements of patrons."

colourful, highly stylized block images that appear in these pages could not have been created in the form they were outside of a technological environment whose parameters can be defined and explained. To borrow from the language of mathematics and



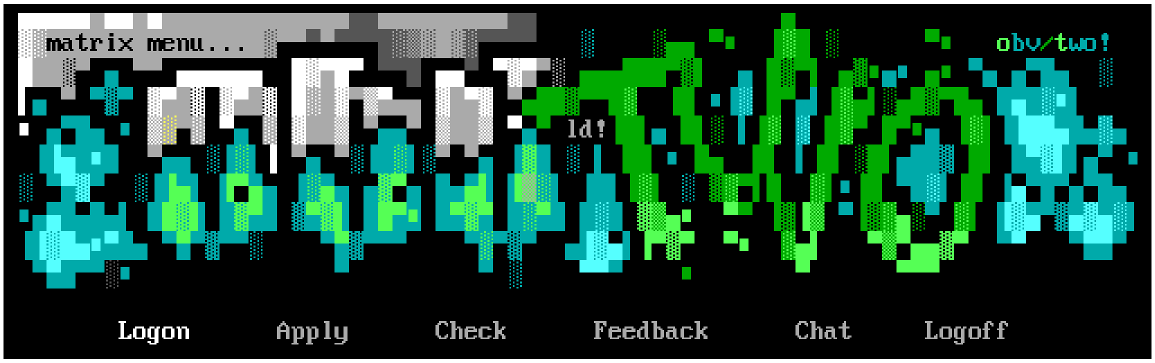
The Form of the Interface II: Stock Output from the "BBS List" function of Charisma BBS software version 1.10, 1994.[11]

computer science, a function expresses a dependence between variables; some of these variables ("input") are known, while the rest ("output") are produced by the operation of a relationship or algorithm. Historians are intimately familiar with this concept because it is the bread and butter of their work: by running derivations against the output of certain events using the input of other events, they seek to define relationships whose operation is responsible for the development of phenomena through time. In this they are the reverse-engineers of causality – technicians of the past working on the algorithm of why.

The images presented here represent just such a discrete series of outputs that can be related back to equally discrete inputs through a causal argument. This form of artwork ("ANSI") developed during the late 1980s, flourished during the 1990s, and disappeared by the turn of the century. It was the product of a unique computing environment in that its form represented a response to the technological constraints of the IBM PC as it existed during this period. It was most often found on that class of bulletin

[11] "Charisma v.1.10 BBS List," in *Charisma BBS Software version 1.10* (Hamilton, Ontario: Grip Microdesigns Inc., 1994), ftp://archives.thebbs.org/bbs_programs/cbbs110r.zip (accessed March 10, 2009).

board systems that used a particular family of software and operated within what has been referred to as the digital underground, the segment of the online world dedicated to



The Form of the Interface III: Matrix Logon Menu by Lord Jazz ("ld"), which appeared in Oblivion/2 BBS Software version 2.30, 1995. Is this art?[12]

hacking, software piracy and other illicit activities. Its creation was inspired by attempts by artists and systems operators to gain access to definable social goods peculiar to the computing paradigm of the era and the patterns of production, distribution and consumption permitted and encouraged by the same. Finally, the development of the aesthetics of the form was driven by technological advances within this paradigm, and its disappearance can be traced to an equivalent market paradigm shift that was responsible for the rise of the Internet.

Beyond the palliation of nostalgia, the purpose of this work is three-fold. First, it will capture and expose examples of a form of expression that, subject to the forgetfulness of the pragmatism of the present, are in danger of being lost forever. Second, it will relate this form back to a particular time period and series of governing conditions to explain why it developed when and in the way that it did. Finally, it will demonstrate the validity of the explanation offered by charting the evolution of the form

[12] Lord Jazz, "Oblivion/2 v.2.30 Matrix Logon ANSI," in *Oblivion/2 BBS Software Version 2.30* (Location Unknown: Darkflame Enterprises, 1995), ftp://archives.thebbs.org/bbs_programs/obv2%2d230.zip (accessed March 8, 2009).

and its demise as these governing conditions changed and, eventually, became inoperative. *In fine*, these artworks may be used as a lens through which the dense network of economic, technological and social factors that inspired their creation might be viewed. More important than this, however, is that their use necessitates the bending and adaptation of certain rules of contemporary historical scholarship. This represents an opportunity to demonstrate that the mode and methodological assumptions of academic history are still viable in an epoch in which digital technology is redefining the historian's basic unit of analysis, the document, in a way that presents new problems in the authentication, use, and preservation of source materials.

All of this is made vastly easier by the fact that the period under study is one of both recent and personal memory, with the latter serving to fill gaps in the record introduced by the twin forces of deletion and obsolescence. While the argumentative essence of history is the interpretation of data through the operation of causality, historical enquiry shares points of convergence with art not merely by its expression through narrative, but because it demands that the historian engage in a work of imagination: that of conjuring the past from the perspective of the present. When the distance between the two can be measured in terms of a few years to a few decades, the disconnect between what is known now and what existed then is proportionately reduced; so too is the imaginative burden. Bias toward the sources emerges because of their proximity, the so-called present-minded fallacy, but there are also more sources available – and as shall be discussed, they are not long-lived.

Categories of Analysis

No good work of research may proceed without defining its terms of reference.

The narrative presented here will draw on four categories of analysis that will be used to identify and characterize certain historical forces and explain the influence they exerted over the development of the form of the artwork discussed here. Drawn from established scholarship in the fields of sociology, history, and the history of technology, these present a conceptual framework through which events can be traced back to their originating causes.[13] In this it should be remembered that categories are a mere conceptual framework foisted on events of greater complexity than can be described using any given schema; when the object of enquiry is the operation of an entire subculture, care must be taken not to view the categories employed as either exhaustive or definitive. Those used here are filters designed to sift data and render it comprehensible, and filters are inherently lossy in that their purpose is to emphasize what is viewed as important by discarding data deemed irrelevant. The story presented here cannot be viewed as the final word on the development of the species of computer artwork under discussion, but instead a preliminary examination designed to encourage further scholarship.

Category I: Constraint

All human activity is subject to a variety of forms of constraint.[14] While freedom may exist in the abstract, philosophical sense of the word, only a sophist would argue that

[13] This work follows up on several important studies in the history and anthropology of software production and aesthetics. On free and open source software, see Steven Weber, *The Success of Open Source* (Cambridge, M.A.: Harvard University Press, 2004); Yochai Benkler, *The Wealth of Networks: How Social Production Transforms Markets and Freedom* (New Haven: Yale University Press, 2006); Christopher M. Kelty, *Two Bits: The Cultural Significance of Free Software* (Durham: Durham University Press, 2008). On new media aesthetics, see, for example, Noah Wardip Fruin and Nick Montfort, eds., *The New Media Reader* (Cambridge, MA: The MIT Press, 2003). On copyright, see Siva Vaidhyanthan, *Copyrights and Copywrongs: The Rise of Intellectual Property and how it Threatens Creativity* (New York: NYU Press, 2003); Lawrence Lessig, *Code: Version 2.0,* 2nd. ed (New York: Basic Books, 2006) and Tarleton Gillespie, *Wired Shut: Copyright and the Shape of Digital Culture* (Cambridge, MA: The MIT Press, 2007).
[14] Roger Garlock Barker, *Habitats, Environments and Human Behavior* (San Francisco: Jossey-Bass, 1978); Robert Gifford, *Environmental Psychology: Principles and Practice* (Boston: Allyn & Bacon, 1997).

there is a one-to-one relationship between abstract freedom and practical or realistic freedom. What this means is that while self-aware entities are arguably free to do as they wish, what they may actually do is constrained, as an example, by their physical and mental capacity, their imagination, the level of socioeconomic development of the society in which they operate (including the availability of resources and goods), and the influence of authoritative, normative structures that proscribe certain behaviours. This sum of physical, macrohistorical and individual forces defines the upper limit of what is possible in a given period; so doing, it describes what is probable within the same.

As a category of analysis, constraint is so intrinsic to the way human beings interact with the world that it is often overlooked. From the assessment of bare physical threat to the execution of strategy, all choice that features an estimation of risk appeals to constraint when evaluating alternate courses of action and hypothetical chains of causality. Constraint may be fixed, or elided by choice; it may be structural and economic, or it may operate individually; it may prescribe hard limits or merely influence behaviour. Most significantly, it may frequently be bypassed or undone by conscious or unconscious human activity. If one accepts that humans are advantage-seeking creatures as a function of their status as biological organisms and that they frequently seek advantage without active knowledge of the object sought or the internal workings of mechanisms they interact with, two conclusions present themselves.[15] The first is that human beings will seek to overcome limitations that affect their ability to survive and reproduce, whether these lie in accessing the bare rudiments of subsistence or higher-order manifestations of the same like wealth, prestige and power. The second is that

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[15] Friedrich von Hayek, *Law, Legislation and Liberty, Volume 1: Rules and Order* (Chicago: The University of Chicago Press, 1973).

knowledge of the existence of a given constraint is not required for that constraint to exert influence over behaviour.

Because constraint proceeds from matters as fixed as the law of conservation of energy to those as flexible as the influence of morality on choice, a description of the relationship between constraint and the development of events is always contentious. Furthermore, because many forms of constraint can be influenced by human agency, causal reconstruction becomes especially difficult as the number of subsidiary factors loosened or tightened by the modification of a discrete constraint spirals out almost to infinity. Historians cut their way through this thicket of relationships through the use of induction, the black box of lived experience whose premises allows a picture of what is believed plausible to be assembled from otherwise undifferentiatable masses of data. That these assumptions are inexplicable in that they cannot be unpacked by their bearer or separated from an individual consciousness explains why the same evidence can produce quite different conclusions and why history is a technical discipline instead of a science: its mechanisms of observation are not separated from its observers, and their calibration cannot be known. Furthermore, as the scale of the constraints considered is increased, so too must be the recourse to induction. Thus while the use of inductive filters is what makes the writing of history possible, such abstraction obscures the nature of what is studied in proportion to the complexity of the system considered.

These factors are diminished when the object of enquiry was produced on a definable, documented technological system. While computers are generative technologies and the influence of certain hardware limitations can be lessened through the use of software, the technical specifications of a computer platform represent a fixed constraint within which all expression via that platform must take place. This is only the case where a given form of expression lives wholly within the system, ie. is both produced and viewed on the same platform without recourse to intermediary actors or technologies, but just such a case is presented in the artwork that will be discussed here. As will be clear by the end of this essay, the form of the type of system that permitted online interaction during the period under study and the gradual evolution of the aesthetics of this form was directly constrained by the limitations of specific technologies used in that period. That the explanation offered here is defensible is demonstrated by the fact that no great inductive leaps are required to link these limitations to the form that emerged.

Category II: Paradigm Shifts

The concept of the paradigm shift is derived from a seminal work in intellectual history, Thomas Kuhn's *The Structure of Scientific Revolutions.*[16] To Kuhn, a paradigm is a way of conceptualizing the universe, one that bounds a specific set of phenomena by explaining them in terms of the paradigm and renders them controllable by the application of its rules. As the accumulation of experimental data gradually reveals the inability of old paradigms to explain physical interactions, pressure builds around the deficient elements of a given theory until it collapses and is replaced by another novel theory that can explain them without logical inconsistency or exception. Kuhn described this process as one that was fundamentally social and constructed instead of epistemologically pure, with the adherents to old paradigms defending them out of the

[16] Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962); John Worrall, "Normal Science and Dogmatism, Paradigms and Progress: Kuhn 'versus' Popper and Lakatos," in *Thomas Kuhn,* ed. Thomas Nickles (Cambridge: Cambridge University Press, 2003).

desire to maintain prestige instead of the purportedly nobler motive of the advancement of knowledge, but the adaptation of the concept presented here will overlook this argumentative thrust in favour of using it as a means to describe fundamental changes to the operative landscape of technology.

Here the paradigm shift takes the form of successive consumer revolutions in technology. These are revolutions of commoditization, defined as the process by which economies of scale render previously expensive, inaccessible and distinguishable goods inexpensive and indistinguishable in the marketplace through their increased availability to the consuming public. Classic historical examples are sugar and coffee, which began as luxury goods before the workings of European imperialism made them a staple of nascent consumer societies. A contemporary example is computers, more accurately described as access to microprocessors, whose successful commoditization was responsible for the decline of the mainframe era that existed prior to 1980 and the rise of the personal computer in the period that followed. Of more recent vintage is the commoditization of network access, a hallmark of the end of the age of the traditional telephone company ("Ma Bell," 1920-1990, R.I.P.) and its replacement by the Internet era. Yet more recent still is the commoditization of software and computing platforms themselves through the development of the open source software movement and cloud computing.[17] What is of interest here is not the reconstitution of physical reality according to a theoretical model, but instead the diminution or elimination of specific market constraints that affect the price and availability of goods. These represent

[17] See Sidney Wilfred Mintz, *Sweetness and Power: The Place of Sugar in Modern History* (New York: Viking, 1985); Jack Manno, *Privileged Goods: Commoditization and its Impact on Environment and Society* (Boca Raton: Lewis Publishers, 1999); Johan Söderberg, *Hacking Capitalism: The Free and Open Source Software Movement* (New York: Routledge, 2008); and Nicholas G. Carr, *The Big Switch: Rewiring the World, from Edison to Google* (New York: W. W. Norton & Co., 2008).

changes in the paradigm of the marketplace, defined as what problems can be solved through the application of the limited capital available to individual consumers and small businesses.

An economic or consumer paradigm shift is typically the direct descendant of a scientific paradigm shift that allows for the emergence of new technology, but this is not always the case. When evaluated from the perspective of the widespread market availability of technology, consumer paradigm shifts may occur simply because of changes in the ancillary technologies that support the production and distribution of goods. As an example of the lead time between a scientific paradigm shift and its consumer equivalent, consider the case of the microprocessor revolution mentioned earlier. While the discovery of the scientific predicates of this shift took place in the 1950s and 1960s, the operation of economies of scale did not bring the application of these technologies within the reach of consumers until the early 1980s.[18] A further example is supplied by the network access revolution of the 1990s. Broadband network access was technologically feasible once innovations in semiconductors and fibre-optics could be combined into a package that transmitted data as light. *Consumer* broadband network access, however, was only *economically* viable once the cost of acquiring and deploying these technologies dropped to a point that permitted the development of a mass market.

In Kuhn's theory, what drives the replacement of a scientific paradigm is its inability to satisfactorily explain certain physical phenomena. In the adaptation used in this paper, what drives consumer paradigm shifts is the inability of the existing

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[18] Ernest Braun, *Revolution in Miniature: The History and Impact of Semiconductor Electronics* (Cambridge: Cambridge University Press, 1978).

technological framework to produce marked improvements in either efficiency or productivity. The personal computer revolution occurred because corporations and consumers found greater efficiencies in adopting a distributed, individualized, on-demand, user-oriented approach to data processing than continuing with the centralized, departmentalized, time-shared, batch-oriented approach common to the mainframe era. Lying underneath the commoditization of the computer was the discovery and successful commoditization of integrated circuits and, eventually, microprocessors, volatile memory and storage media.[19] Likewise, the network access revolution occurred because of the need to communicate across great distances at costs lower than those charged by traditional telephone companies and because greater efficiencies could be realized by both connecting users to each other and liberating purchasers from vendor-specific network implementations. These demands drove the development of last-mile infrastructure solutions and the adoption of the Internet Protocols (TCP/IP) as the standard means of network information interchange.[20]

Economic paradigm shifts are macrohistorical events because they fundamentally alter how goods are produced, distributed and consumed. They do this because commoditization brings the cost of formerly emergent technologies down to the point where they can be acquired and used by typical consumers and businesses. A scientific paradigm shift is always of historical interest because of the discoveries it produces and the way in which it alters our understanding of the universe, but of greater relevance to the study of consumer societies is the operationalization of a new concept in the form of

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[19] Carlota Perez, *Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages* (Cheltenham, UK: Edward Elgar, 2002).
[20] Edward J. Malecki, "The Economic Geography of the Internet's Infrastructure," *Economic Geography 78,* iss. 4 (October, 2002): 399-424.

the adoption of the technologies derived from it.

Category III: Operating Environment

Operating environment is best defined as the complex ecology of hardware, software and network technologies that are the product of an identifiable technological or consumer paradigm shift. It can comprise everything from the availability of technology to its prevalence, the geographic and demographic features that govern its use and, as defined by the paradigm, the natural limitations of the technologies in question. In the history of computers, the implementation of technology in the form of a discrete, integrated package is best described as a platform.[21] This is a combination of hardware and software that defines the framework through which computing resources can be accessed and used. While any mathematical function or repetitive operation can be implemented in software, the specifications of the hardware that underlies the platform represent a fixed, upper-limit constraint that defines the absolute range of software that may run on it. Beyond this, operating systems – the system software that provides applications with an interface layer to the underlying hardware – represent a constraint that determines the practical range of software that can exist on a given platform.

It is thus natural that the limitations of a given platform will define the forms of expression that can be sustained on it. Consumer-grade digital video did not exist in the 1980s because the computing platforms dominant in that era did not permit it: their hardware was insufficient to the task, and because of this insufficiency no software that

[21] Of late, scholars have recognized the utility of the platform as a lens through which other social and economic phenomena can be exposed. This technique represents one of the central methodologies of this work. See Ian Bogost and Nick Monfort's book series, "Platform Studies," available at http://www.platformstudies.com, and the first book in the series: Nick Montfort and Ian Bogost, *Racing the Beam: The Atari Video Computer System* (Cambridge, MA: The MIT Press, 2009).

might permit expression in this form was developed. Certain elements of a given mode of digital expression are thus uniquely referable to the constraints of the platform on which they took place. At a higher layer of abstraction, these constraints also define the social aspect of patterns of use: because they were centralized resources, mainframes encouraged the development of communities bounded in physical space. The natural opposite to this are microcomputers, which tend to produce communities bounded by the reach of the networks they are capable of accessing.

It would be a mistake, however, to think of platforms and operating environments as equivalent concepts. The difference between the two is one of scale: while a platform is bound to a single object in the form of a computer, operating environment refers to the *overall* technological context in which computing takes place. As such it absorbs everything from the way in which computing resources are packaged to the means through which computers can be connected to each other (networking technology and topology), the ways in which software is produced and distributed (closed or open source, physical or virtual media) and, most importantly, the range of social and other goods available through the use of technology and the mechanisms that control access to these goods.

The best way to illustrate the effect of the constraint of operating environment is by examining a good desired across periods separated by different paradigm shifts and the way in which technology influences the social interactions that permit access to this good. Software piracy exists in both the period under study and the present because individuals desire commercial software products but in many instances would prefer not to pay for them. Where applicable, they would also prefer to avoid being prosecuted for copyright infringement. When the distribution of commercial software (which is price-scarce) takes place via physical media due to the absence of digital access points through which it may be acquired, piracy assumes the form of the "sneakernet" – the physical passing of disks between individuals. Here there is concurrence between the physical social network in which an individual broadly operates, the social network through which they acquire commercial software, and the assessment of trustworthiness that permits access to the same.

When the same basic conditions of distribution persist but the public (in this case telephone) networks allow for the creation of informal digital distribution points, the result is the disruption of the link between the physical and social networks that give access to these goods. As was the case in the 1980s and early 1990s, this encourages the rise of virtual communities whose membership is bounded by what geographic and economic constraints are reflected in the structure of the network (area codes and long distance charges). Legal liability is mitigated through the putative anonymity of the medium, though this means that trustworthiness can only be determined by how users present themselves to others, how vigorously they participate in the illegal distribution of software, and how well they demonstrate their commitment to the values of the community by adopting its expected attitudes and self-expressive tropes. Finally, when the network no longer carries forth geographic constraints as strongly, the result is the creation of user communities bounded only by the broad limitations of language, interest, and network accessibility. This is the case with post-millennial software piracy, which recognizes limitations of geography and jurisdiction only to the extent that siting server assets in certain countries reduces the risk of civil or criminal sanction.

What should be clear from the preceding is not just how operating environment affects the likely form of user interface, as is the case with hardware and software limitations, but also how it is produced by paradigm shifts that strongly influence the social aspects of computer use. The production of the artworks that will be analyzed here occurred in a definable operating environment that exerted two forms of pressure. The first, an unavoidable constraint, was inherent in the medium through which they were created and viewed: the limitations of the platform used by their authors was directly responsible for specific aspects of the form of their expression, and identification of these limitations gives a strictly technological explanation of why they appeared as they did. The second, a persuasive or influential constraint, proceeds from the features of the overall operating environment of the period instead of those restricted to a given platform. By demonstrating how larger economic factors affected patterns of computer use and thus the reasons why the online communities that were the galleries of these artworks developed, a more comprehensive explanation of the motivation of the artists and the tropes they employed emerges.

Category IV: Ethos

The final constraint that will be employed in this analysis is ethos, defined as the characteristic spirit of a people or community. Ethos consists of the overt and latent values of a group unified by geographic propinquity, historical circumstance or voluntary association, and these define the virtues and vices that are held up for approbation or reprobation by members of the group.[22] Values may be completely organic to the entity

[22] A. L. Epstein, *Ethos and Identity: Three Studies in Ethnicity* (New Brunswick, NJ: Aldine Transaction, 2006).

which sustains them, but they are far more frequently defined by interaction between the group and either economic constraint or other social actors. While ethos traditionally describes the spirit or belief system of those living in an embedded community joined by ties of kinship or nationhood (so-called historical "peoples"), in the context of a modern, diversified, industrialized society it is more appropriate to describe not a single ethos but multiple cultural constructs operating at national, regional, cultural and sub-cultural levels.[23]

It is the adoption or rejection of the values contained in ethos that defines the baseline for membership in a given community – at least so long as such membership is construed beyond the merely physical or geographic. The acceptance of values may occur through acts observable by others, but more typical is the signalling of acceptance through the use of symbols. These may range from simple statement or braggadocio through to expressions as complex as reputation and style. Within a group, power and prestige flow to those individuals who control access to resources or whose conduct best embodies the values the group considers praiseworthy. Values themselves are reinforced and gradually modified through individual or collective acts of performance.[24] Ethos acts as a constraint on behaviour by defining what should and should not be done by members of a given community in order to sustain membership in that community. Like paradigm shifts and operating environment, the relationship between ethos and the actions of community members is not deterministic; much as the first two are products of economic and technological evolution, ethos is the sum of a continuous process of social evolution.

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[23] For a good treatment of embedded communities, see Charles Taylor, *Modern Social Imaginaries* (Durham: Duke University Press, 2004). Historical peoples are discussed in John Alexander Armstrong, *Nations Before Nationalism* (Chapel Hill: University of North Carolina Press, 1982).
[24] Andrew Parker and Eve Kofosky Sedgwick, eds. *Performativity and Performance* (New York: Routledge, 1995).

As the products of human endeavour, then, ethos and operating environment therefore influence free will as much as they can be undone by it.

Certain factors distinguish the ethos of online communities from all others, however. The first is that online communities do not exist in physical space, so the assessment of value-conformity by their membership must take place through representation or symbolism. As these communities operate outside the bounds of traditional social surveillance, members must repose a higher degree of trust in the representations of their peers. The second is that participation in these communities is voluntary in a way that membership in physically bounded communities is not. To join an online community one must connect to it, and when the relationship between "real" identity and representative identity is disrupted by the anonymizing interposition of the terminal and the network, no force of involuntary peer pressure or equivalent social coercion exists. This is only truly the case in completely anonymous online communities – as an example, the pressure to join non-anonymous social networking sites like Facebook can be quite high – but where the artwork discussed here achieved its fullest flowering was on systems that eschewed the use of real names.

Addressed here under the banner of ethos are the values of the pre-Internet digital underground. Their examination permits the reconstruction of what was important to members of the archipelago of systems that defined this branch of the online world during the period under study. It also offers insights into why some messages and aesthetic choices, tropes by any other name, were repeated and reiterated by artists who adopted the form. As will be clear by the end of the analysis, the technological paradigm of the era and the operating environment it produced were responsible for the framework in which these values developed, with changes to both of these constraints producing the permutation of these values that persists into the present. The novelty of the medium, for no widely-available online communities existed prior to the 1980s, means that the period examined here represents the first instance in which these values emerged. As such, studies like this stand as the mooring stones of what will hopefully become a new platform of historiography.[25]

Problems of Historical Research in the Reconstruction of Online Communities

History became a professional discipline in the late nineteenth century, and many of the assumptions of that period are carried forth in its current conceits. Foremost amongst these is the privileging of the document within the general category of sources. While the definition of what qualifies as a document has expanded tremendously over the past fifty years, the key criterion that distinguishes documents from all other sources remains: as a representation of information, they must typically take a bounded, physical form. The reasons for this are straightforward and go to the heart of historical methodology. Elementary analysis of sources begins with defining what they are and determining when, where and by whom they were produced, all core components in the process of authentication and weighting that defines the relationship between historian and evidence. These tasks are proportionately easier with physical documents for four reasons, namely that they are sight-verifiable; the location in which they are found provides evidence of authorship, intent and authenticity; the constituent parts of the document (ink, paper, etc.) can be studied forensically; and the cost in effort to produce a

[25] For a recent example, see Fred Turner, *From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism* (Chicago and London: University of Chicago Press, 2006).

physical forgery is high enough to make such occurrences unusual. Furthermore, the citation formats most commonly employed in the writing of history are geared toward the documentary products of the pre-digital era, namely books, articles, letters, reports, bureaucratic minutiae and so forth that with identifiable authors, publishers, and publication dates.

Sources that are created, viewed and stored entirely in the digital domain often fail to carry these heuristics, especially when they are created informally. The identity of authors is obscured by their use of pseudonyms and the anonymous nature of networked communications. The physical identifiers that allow documents to be traced to a particular place and time are reduced to what limited and untrustworthy information is captured by the filesystem on which they reside. Perhaps most importantly, the technological platforms that allow for the display of sources like these as they would have appeared when new are gradually degraded and eliminated through obsolescence. These are not sources that can be held in the hand or which hold out the prospect of palimpsest, and they cannot typically be stored in an archive in a way that preserves their original integrity. Paper, parchment, animal skins, stone and wax tablets and all of the other traditional vehicles of information interchange are incredibly long-lived when compared with their digital counterparts. They can survive fire, flood and physical decay; they may moulder unmolested in an attic or basement until a researcher finds them and puts them to use. No medium of digital storage whose lifespan can be counted in more than mere decades presently exists, and beyond physical media lie the problems of file format, encoding and compatibility.[26]

[26] Roy Rosenzweig, *Clio Wired: The Future of the Past in the Digital Age* (New York: Columbia University Press, 2011).

Because of its inherent preference for the physical instead of the digital, the reconstruction of history through the use of primary sources inexorably privileges those groups and individuals who were organized enough to record their activities on traditional media. Entities constructed along formal lines of organization, be they government ministries, benevolent societies, political pressure groups or any number of equivalent analogues, have long stood as the standard subjects of research. Where historians have used digital sources they have typically done so as an adjunct to "real" historical scholarship, namely spelunking in archives, assembling narrative threads from packets of correspondence, or close-reading diaries. This is partially due to the origins of the current generation of practising historians, many of whom were reared in an era in which the definitional integrity of the document had not been as undermined by digitalization as it is at present. But it is also because academic history as it currently exists is ill-suited to an age of continuous, seamless connectivity and point-to-point communication through machines.

Beyond the problem presented by the changing nature of the document in the twenty-first century is the issue of boundedness, for until now historians have been able to view the authors of documents through the lens of social formations that are in some way referable to physical space, be they in the form of nation, class, ethnicity and so forth. While these concepts still work even in a period of intense globalization, as most economic and social activity still takes place primarily in the physical world, they fail spectacularly when applied to communities that exist solely within the realm of the network. How does one apply either traditional methods of documentary analysis or traditional conceptual frameworks to an online message board or a chat room? How does one evaluate transnational entities that are bounded only by the electronic protocols that carry their communications? The antecedents of this development lie in the telephone and telegraph, but neither of these media presented an environment like that of the present, in which an unavoidable bifurcation between the real and virtual self has emerged. The denizens of a given time period often think that the age in which they live is without precedent, but the changes that have been wrought by the rise of the Internet and its precursor technologies have made the present different from the past in a manner that is unusual.

The problem currently faced by history is but another facet of the problem currently faced by newspapers and record labels, namely the commoditization of information. Privileged publishing points no longer exist as the capital required for mass publication is within the reach of more people than ever before, but this cost is reduced because of the ephemeral nature of the medium in which such publication takes place. Similarly, the primacy of physical archives has been reduced because an archive can now be anywhere computing, mass data storage and networking technology converge. The difference between these archives and those that preceded them, however, is that digital document repositories can be destroyed by simple deletion instead of more cataclysmic acts of God and their contents can never be said to be either authoritative or subject to standard methods of authentication. Sources must be taken on their own merits like never before, and sources must be recognized as both more fragile and difficult to access than those that exist on paper or other immediately-accessible physical media.

To meet these challenges, certain rules of historical scholarship must be bent or suspended. First, the document author must be acknowledged as truly dead, or at least the conception of the author as a physically discrete entity that can be known beyond his or her voluntary, symbolic representations of self. The artists who created the works studied here operated anonymously and there is no ready or plausible means of discovering their personal histories as a way of understanding why they created what they did. Second, the notion of place and time as features that root a document in a specific milieu cannot be sustained when evaluating documents created and viewed wholly digitally: one cannot know where a document was created as the site where it is found gives few clues as to its origins, and one cannot rely on the date information carried within a document for any reason other than sheer necessity as the relationship between date and document is anything but indelible. Third, none of these documents can be viewed in their original context as the systems that hosted them have all been destroyed by obsolescence. While the hardware on which such systems ran can still be acquired, this will not be the case within approximately two decades, and while these hardware platforms can be emulated in software, such emulation only imperfectly captures the feel of the original systems.

From these premises a set of broader assumptions are derived, and it is these assumptions that make the writing of this work feasible. Undergraduate students of history are warned to be mindful of the present-minded fallacy, specifically the fact that the interpretation of events of recent vintage is made more complicated by the lack of emotional distance between researcher and subject. The concern is that the values of the present or the conclusions that proceed from the same will be carried too strongly into the interpretation of the available evidence. Because the window in which digital sources of the type examined here – those of spontaneous, self-organizing communities – can be found and analyzed is compressed by the nature of the sources themselves, so too must be the length of time that separates acceptable subjects of research from those that are considered too close to the present.

Next, because the memory of the systems that sustained these sources, the "feel" or atmosphere created through the use of these systems and the ethos that this gave rise to exists most completely in the minds of those who used them, certain of the techniques of personal memoir must be enlisted if a comprehensive image of the period is to be assembled. Much must be taken through the recollection of these "eyewitnesses" and, although memory is unquestionably fallible, given weight on their authority alone. Finally, because these sources carry so few bibliographical details of their own, the rules of citation must be weakened if they are to be incorporated into the work. Here they are frequently given approximate titles and estimated dates, and while part of the final chapter is devoted to discussing two of their most prolific "publishers," the analysis there is speculative at best.

The considerations and assumptions advanced in this and prior sections provide a rough outline of how this study will proceed. The overall scene will be set by discussing the paradigm shift that permitted the rise of the microcomputer and describing the secondary technologies that developed in the market churn created by competition between computer platforms. This partial picture of the operating environment of the era will be complemented by a treatment of the market constraints, mainly in the form of networking technology, which encouraged the development of the type of online systems that hosted these artworks. Next, the platform-specific technological constraints that defined the building-blocks of the form will be identified, and the way in which gradual changes in these constraints affected how these artworks were created and viewed will be analyzed. Finally, ethos of the digital underground – its values and how they were shaped by the operating environment in which they emerged – will be analyzed in an attempt to explain the social forces that encouraged artists to develop this mode of expression.

II

Digital Ecology in Evolution: Paradigm, Operating Environment and Platform

> *Cyberspace.* A consensual hallucination experienced daily by billions of legitimate operators, in every nation, by children being taught mathematical concepts... A graphic representation of data abstracted from banks of every computer in the human system. Unthinkable complexity. Lines of light ranged in the nonspace of the mind, clusters and constellations of data. Like city lights, receding.
>
> -- William Gibson, *Neuromancer*[27]

The first link in the chain of events that explains the emergence of ANSI art, the dominant mode of artistic expression of the computer bulletin board systems of the 1980s and 1990s, is the consumer paradigm shift referred to in these pages as the microprocessor revolution. The development of microprocessor technology, its commoditization, and its integration into the personal computer represented a fundamental weakening of market barriers that inhibited consumer access to automated data processing technology. It is natural, then, that the history presented here begins by providing an overview of the origins of computing technology and an explanation of how hobbyist-entrepreneurs eventually came to create a mass market for such devices.

This paradigm shift was only the beginning, however: once consumers began to adopt the microprocessor in earnest, other adaptive changes took place within the technological operating environment of the period. IBM entered the personal computer market in force and came to define the dominant hardware platform of the age; as this

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[27] William Gibson, *Neuromancer* (New York: Ace Books, 1984). This represents the point at which the term "cyberspace" entered the modern lexicon – Gibson invented it for *Neuromancer.*

was the native environment of ANSI art, the peculiar reasons for its success will be briefly discussed. Next, as the most widely accessible public network in the period was the public switched telephone network, a short treatment of the history of the North American telecommunications network and the popularization of the analog modem, again a product of the actions of hobbyist-entrepreneurs, will be provided. Finally, as ANSI art achieved its highest form on that class of bulletin board systems that specialized in software piracy, we shall address the ways in which the microcomputer and the modem both created a market for personal computer software and affected the ways in which it was distributed. By the end, a complete picture of the broad technological constraints that defined the technological operating environment will emerge – and through it, an exposition of the economic premises required to permit expression through ANSI art.

When considering the relationship between a precursor technological breakthrough and its eventual transformation into a market paradigm shift, it is important to remember the role of popularization and the dialectic relationship between independent technology popularizers and established business entities. While scientists are responsible for bridging the gaps in knowledge that eventually lead to new consumer technologies, in the computer industry it was frequently the technicians who, by virtue of their work in the big information technology businesses of the day, helped new technology escape from its corporate or scientific cloister and applied it to the problems faced by consumers. Without hobbyists, whose activities proved that a market for *personal* computers was viable, the industry would not have appeared at the time that it did; without corporations reaching down and exploiting opportunities the hobbyists had made obvious, the mass market for this class of devices might have developed much more slowly. Hobbyists were likewise responsible for the consumer adoption of the modem and the invention of the bulletin board system. Through this, they inadvertently ensured that BBS operators were private, non-institutional actors, a fact responsible for the origins of mass software piracy and, through it, the unleashing of social pressures responsible for the finest examples of ANSI art.

What each of these developments represents is a response to market constraints in the form of the price-accessibility of technology. Where these constraints weakened, as was the case with the microprocessor, first-generation computer hobbyists found that their desire for creative expression through technology was no longer price-inaccessible. Where they remained strong, as was the case with telephone long distance rates or the price of software once the personal computer market became established, second-generation hobbyists – ones whose level of technological sophistication made them users of technology rather than pioneers – determined how these new technologies could be used to access sought goods at reduced cost. What separates the hardware hackers of the 1970s from the ANSI artists of the 1990s is the scope of the constraints under which they operated: the former leveraged the overall technological environment of the era to create new platforms out of nothing, while the latter worked within the much more fine-grained constraints of their chosen computing platform to, amongst other things, conjure artwork out of the ether.

The Microprocessor Revolution

Prior to the late 1970s, computing took place on mainframe computers.[28] These

[28] Paul Ceruzzi, "Nothing New Since von Neumann: A Historian Looks at Computer Architecture, 1945-1995," in Paul Rojas and Ulf Hashagen, eds., *The First Computers – History and Architectures*

were expensive, physically imposing batch-processing behemoths produced by big names in American business like Honeywell, Westinghouse, UNIVAC and the ubiquitous IBM. While mechanical quasi-computing devices have existed since time immemorial, what distinguishes a modern computer from its mechanical precursors is the fact that the former represents an unchangeable implementation of a specific subset of functions while the latter, so-called "universal" computers, are theoretically capable of implementing any algorithm in software.[29] Computers have been conceptualized as thinking machines, but in reality – or at least at present – they are little more than complex calculators producing results according to determinate, human-designed mathematical functions.[30] The productive strength of computers lies in their ability to process data, specifically their ability to substitute electronic effort for its human equivalent in the execution of repetitious calculations.[31]

The natural applications of computing technology are in the automation of repetitive processes, such as the performance of calculations that require speed, precision, the use of large data sets, or any combination of the above. It is thus unsurprising that both the initial and, until recently, largest users of computers have been corporations and government entities responsible for tasks like the collection of census data, the management of sophisticated supply chains, the maintenance of accounts, the integration and control of discrete systems, or the physical modelling of reality.[32] Modern

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(Cambridge, MA: The MIT Press, 2000), 195-217.

[29] Martin Davis, *The Universal Computer: The Road from Leibniz to Turing* (New York: Norton, 2000).

[30] Technology is already undercutting this assertion. See Clive Thomson, "What is IBM's Watson?" in *The New York Times Magazine Online*, June 14, 2010, http://www.nytimes.com/2010/06/20/magazine/20Computer-t.html (accessed June 22, 2010).

[31] Jo Marchant, *Decoding the Heavens: A 2000-Year-Old Computer – and the Century-Long Search to Discover its Secrets* (Cambridge, MA: Da Capo Press, 2009); Ettiore Carrucio, *Mathematics and Logic in History and Contemporary Thought* (London: Faber and Faber, 1964).

[32] Michael R. Williams, *A History of Computing Technology* (Los Alamitos, CA: IEEE Computer Society

computing developed under the pressure of wartime, and its immediate applications were in trajectory calculation, fire control, and cryptography and statistical analysis.[33] State-level actors could afford the punitive costs associated with deploying and developing new technologies and could command the labour of cutting-edge researchers and finance research through the twin motivators of taxation and conscription. Although one might expect that the end of the Second World War would bring with it a reduction in government-backed research expenditures, the onset of the Cold War and the creation of the national security state and permanent defence research establishment it required ensured continued capital investment in this area.[34]

Mainframe computing carried the imprint of the historical circumstances that encouraged its development and the culture of its great patrons, namely government and the defence industry. Mainframes were expensive, physically imposing, centralized installations of massively parallel data processing technology.[35] In terms of infrastructure, they required dedicated power, heating, ventilation and air-conditioning systems as well as consumables provided by their manufacturers and a small army of dedicated technicians and administrative staff to keep the system running.[36] Operating continuously for efficiency and executing programs in batch, they had no user interface beyond punch cards or tape until the development of time-sharing and inexpensive

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Press, 1997), 154-293; Los Alamos National Laboratory, *Evolving from Calculators to Computers* (U.S. Department of Energy, Los Alamos National Laboratory, 1993), http://www.lanl.gov/history/atomicbomb/computers.shtml (accessed January 12, 2010).

[33] Jack B. Copeland, ed., *Colossus: The Secret of Bletchley Park's Codebreaking Computers* (Oxford: Oxford University Press, 2006); James W. Cortada, *Information Technology as Business History: Issues in the History and Management of Computers* (Westport, CT: Greenwood Press, 2006).

[34] Paul N. Edwards, *The Closed World: Computers and the Politics of Discourse in Cold War America* (Cambridge, MA: The MIT Press, 1996), 43-73; 282-294.

[35] George Gray and Ronald Q. Smith, *Unisys Computers: An Introductory History* (Self-published: Lulu.com, 2008), http://www.lulu.com/product/hardcover/a-history-of-unisys-computers/4627477 (accessed July 4, 2010).

[36] William Aspray and Martin Campbell-Kelly, *Computer: A History of the Information Machine* (New York: Basic Books, 1996), 131-153.

terminals in the 1960s and 1970s. Their basic technologies and systems architecture, however, were scarcely different from those of today: they used volatile memory for program and variable storage, employed integrated circuits for in their processors and input/output units, and allowed for the connection of a variety of peripherals through buses. They ran stored programs and conformed to the design of the von Neumann architecture.[37] Microcomputers differ from mainframes only in their size, cost, availability, complexity and degree of integration, for what separates them from their forebears is no great technological leap beyond incremental improvements in miniaturization, energy efficiency, scale, cost of production, and their degree of architectural parallelization. Both stood on the ground broken by the development of the transistor and the integrated circuit, and both became commercially viable in their respective eras in the main because of advancements in manufacturing technology.

Indeed, the only major difference between a microprocessor and the central processing units of mainframe computers is that the former places all of the basic subsystems required by a CPU on a single integrated circuit. This became possible because of advancements in the number of transistors that could be packed on a single die, with small-scale circuit integration (SSI, tens of transistors) gradually being replaced by medium-scale integration (MSI, hundreds of transistors) in the late 1960s, large-scale integration (tens of thousands of transistors) in the mid-1970s, and finally very large-scale integration (VLSI, hundreds of thousands of transistors) in the 1980s and beyond.[38]

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[37] Davis, 177-197.

[38] F. M. Klassen, "LSI Bipolar Devices and Technology," in *Large Scale Integration: Devices, Circuits and Systems,* M. J. Howes and D. V. Morgan, eds., (Chichester, UK: John Wiley & Sons, 1981), 13-46; Lawrence Altman, "Special Report: C-MOS Enlarges its Territory," in *Large-Scale Integration* (New York: McGraw-Hill Publications, 1976); Lynn Conway and Carver Mead, *Introduction to VLSI Systems* (Reading, MA: Addison-Wesley Publishing Company, 1980); Arjun N. Saxena, *Invention of Integrated Circuits: Untold Important Facts* (Hackensack, NJ: World Scientific, 2009).

Integration on this scale streamlined manufacturing and reduced the cost of processing capacity to the point where computing technology became price-accessible to the consumer market. Although the history of the computer industry tends to emphasize the role of business and hobbyists in the widespread adoption of the microprocessor, it has recently become clear that the first microprocessor was not the Intel 4004, but instead the highly classified Central Air Data Computer of Garrett AiResearch, which was designed as the core of the avionics package of the US Navy's F-14 Tomcat fighter aircraft.[39]

Fascinating though it may be, the role of the Cold War in the creation of the microprocessor is less important than the alterations wrought in business and consumer life by the commoditization of microprocessor technology. The first consumer applications of microprocessors were in desktop calculators like the now-famous Busicom 141-PF, which in 1971 used the aforementioned Intel 4004 as – not unexpectedly – a lower-cost, less-complex alternative to the custom chipset originally designed by the company.[40] The gap between the desktop calculator and the personal computer, however, was bridged by the maturation of the early market for microprocessors and the application of the growing expertise of small-scale systems designers to the problem of consumer-grade computing. Within the vibrant electronics hobbyist communities in the United States lay untapped repositories of talent that would serve as both the first innovators and first marketplace for generalized computer

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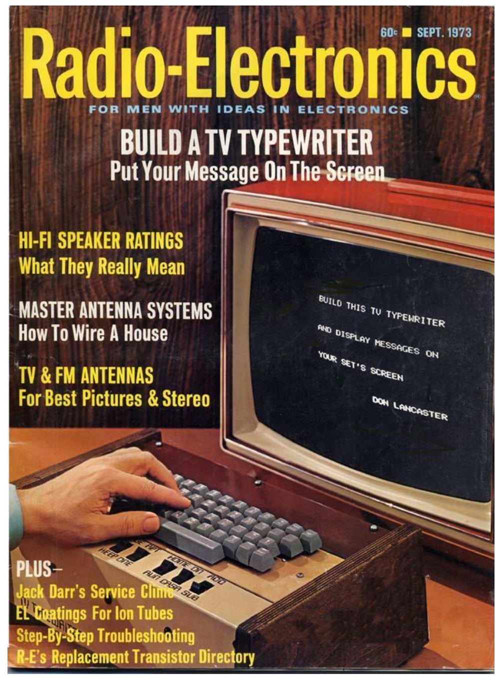
[39] The standard (and very short) history can be had in Aspray and Campbell-Kelly, 236-7; compare this with Ray M. Holt, *Architecture of a Microprocessor* (Location Unknown: Self-published, 1971), http://firstmicroprocessor.com/documents/ap1-26-97.pdf (accessed February 3, 2009).

[40] Intel Corporation, "Product Timeline," in *Intel Museum* (Santa Clara, C.A.: Intel Corporation, n.d.), http://download.intel.com/museum/research/arc_collect/timeline/TimelineDateSort7_05.pdf (accessed February 5, 2009); Intel Corporation, "Intel's First Microprocessor: The Intel 4004," in *Intel Museum* (Santa Clara, CA: Intel Corporation, n.d.) http://www.intel.com/museum/archives/4004.htm (accessed February 5, 2009); CPU-Museum.com, "2 / 4-Bit Microprocessors," in *CPU-Museum.com* (Karlsruhe, Germany: CPU-Museum.com, n.d.), http://www.cpu-museum.com/4004_e.htm (accessed February 5, 2009).

implementations targeted at individual users instead of large corporations or research institutions.[41] The abundance of university-level courses in the FORTRAN (and later BASIC) programming language for students in engineering, mathematics and the physical sciences meant that the market problem of personal computing was one of availability and cost instead of knowledge; likewise, popular interest and aptitude in electronic engineering meant that this problem could be solved by individual users in a way that met the needs of individual users.[42]

The use of a keyboard or keyswitches and monitor as input and output devices for controlling a computing platform had held sway since the their combination in the US Strategic Air Command's Semi-Automatic Ground Envrionment (SAGE) system in the 1950s, but far more familiar to the contemporary user of technology is the form assumed by Don Lancaster's TV Typewriter.[44] At the time its circuit design was released to the public in Radio-Electronics magazine in 1973, keyboards and cathode ray tube (CRT) monitors



Lancaster's TV Typewriter: Radio-Electronics, September, 1973.[43]

[41] Asprey and Campbell-Kelly, 233-236.

[42] FORTRAN was certified by the American National Standards Institute in 1966: see American National Standards Institute, *USA Standard Fortran* (New York: ANSI Inc., 1966), http://www.fh-jena.de/~kleine/history/languages/ansi-x3dot9-1966-Fortran66.pdf (accessed February 6, 2009). ANSI produced a similar technological specification for so-called "Minimal Basic," a derivative of Dartmouth BASIC, at about the same time BASIC interpreters took the nascent microcomputer world by storm: see American National Standards Institute, *ANSI X.360-1978 For Minimal Basic* (New York: ANSI Inc., 1978).

[43] Don Lancaster, "TV Typewriter," in *Radio Electronics 44,* iss. 9, (September, 1973): 43-52.

[44] *Semi-Automatic Ground Environment (SAGE),* (Washington, DC: Federation of American Scientists, 1999), http://www.fas.org/nuke/guide/usa/airdef/sage.htm (accessed February 6, 2009); *Semi-Automatic Ground Environment (SAGE),* (Bedford, MA: MITRE Corporation, 2005), http://www.mitre.org/about/sage.html (accessed February 6, 2009); Edwards, 75-112.

were expensive, speciality devices that were either price-inaccessible to consumers or available only to large manufacturers. This design, which was sold in a kit containing printed circuit boards that were to be assembled by hobbyists, represented but one instance in which specialized technology osmosed from its institutional incubators – at the time of its creation, Lancaster worked in developing displays for the US military – into the consumer marketplace. The permeable membrane of people that separated the initial designers of technology and those that sought to make it accessible to the mass consisted of those expert enthusiasts that comprised the core readership of magazines like *Popular Electronics, Radio-Electronics* and the genre-setting *Byte.*

The pattern of development of devices like the TV Typewriter illustrates certain key features of the dawn of the microcomputer era. While military procurement drove the development of specific technologies and the economies of scale generated by the same reduced prices to the point that these technologies could be acquired by the public, their integration into widely-accessible platforms proceeded through amateurs instead of industry.[45] The Altair 8800, one of the first popular minicomputer designs, was kit-assembled from what were still expensive but nonetheless off-the-shelf components.[46] Popularization of these underlying technologies took place more in the garage laboratory than the research and development facilities of established manufacturers, though the latter (Xerox' Palo Alto Research Centre is but one example) exerted an undeniable influence over the shape of the consumer-oriented industry to come.[47] The exception to

[45] John Markoff, *What the Dormouse Said: How the Sixties Counterculture Shaped the Personal Computer Industry* (New York: Penguin Group, 2005).
[46] Oldcomputers.net, "MITS Altair 8800," in *Oldcomputers.net* (Orange County, CA: Oldcomputers.net, n.d.), http://oldcomputers.net/altair.html (accessed February 6, 2009).
[47] Douglas K. Smith and Robert C. Alexander, *Fumbling the Future: How Xerox Invented, Then Ignored, the First Personal Computer* (New York: Penguin Group, 2005); Mike Tuck, "The Real History of the GUI" in *Sitepoint.com* (Collingwood, Australia: Sitepoint.com, 2001),

this lovely narrative, one which draws rather heavily on the uniquely American trope of the tinkerer whose mechanical expertise eventually results in riches, is found in crossover companies that adapted business-oriented lines of manufacture to emerging consumer demand for automated data processing technology. Even these, however, originated with single individuals: there could be no Commodore PET, a popular early microcomputer design, had founder Jack Tramiel not shifted that corporation's focus away from typewriters to desktop calculators, and then from calculators to general-purpose computing devices that used substantially the same technology.[48] The microcomputer revolution was thus one of technological popularization instead of breakthrough, with incremental advancement and end-over-end increases in demand driving adoption.

Just such a technological fairy-tale exists in the example of Apple Computer Inc., established in Cupertino, California in 1976. The company began by selling the Apple I, a kit computer assembled by hand by acknowledged engineering genius Steve Wozniak in the garage of his business partner, Steve Jobs. They sold prized personal chattels to finance the development of their computer, built the system around the MOS 6502, the cheapest available microprocessor at the time, employed an open, documented architecture in deference to the hobbyist community that represented the foremost market for the device, relied on the expertise of their users to add necessary components to the system (a display and keyboard were not included), and were hardly sanguine about the prospect of long-term success or profitability.[49] Subsequent models released in the late

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http://articles.sitepoint.com/article/real-history-gui (accessed February 6, 2009).

[48] Brian Bagnall, *On The Edge: The Spectacular Rise and Fall of Commodore* (Winnipeg: Variant Press, 2006).

[49] Michael Moritz, *The Little Kingdom: The Private Story of Apple Computer* (New York: W. Morrow & Company, 1984); Glen Sanford, “Apple I,” in *Apple-History.com* (Alameda, CA: Apple-history.com, n.d.), http://www.apple-history.con/model=aI (accessed February 6, 2009); Andy F. Mesa, “Apple I,” in *The Apple Museum* (Unterhain, Germany: The Apple Museum, n.d.),

1970s introduced expansion slots, long a feature of other designs originally targeted at hobbyists, floppy disks, high-resolution graphics, and an operating system that consisted of a BASIC interpreter running in read-only memory (ROM).[50] Sales of the platform trailed behind the offerings of Tandy and Commodore, both of which entered the personal computer market at approximately the same time, until an elemental feature of the microcomputer paradigm catapulted the company to rapid success. This was user-designed software, specifically VisiCalc, the world's first spreadsheet application.

VisiCalc represents the first and best example of a “killer app,” a computer program that so thoroughly meets an emergent technological need or is so desirable that it drives the mass adoption of the subsidiary technologies required to use it, specifically the computer platform for which it was designed.[51] Between its creation in 1979 and its replacement in 1985 by second-generation spreadsheet software (notably Lotus 1-2-3), VisiCorp sold somewhere in the neighbourhood of 600,000 copies of VisiCalc, made its founders millionaires several times over, and catapulted Apple Computer from a garage-workshop company to a major national enterprise. In the process, it created a new market for productivity software that was rapidly entered by both upstart corporations like Lotus and established players like IBM.[52]

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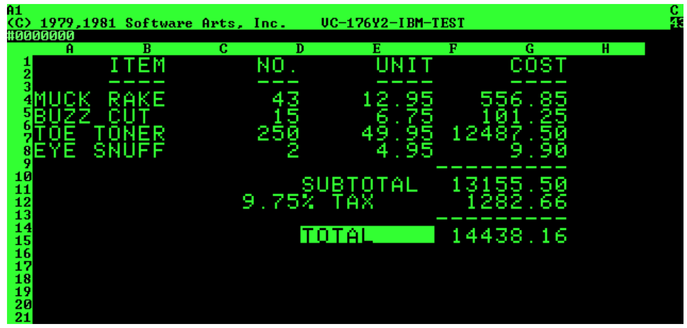
http://applemuseum.bott.org/sections/computers/a1.html (accessed February 6, 2009).

[50] Steve Wozniak, *iWoz – Computer Geek to Cult Icon: How I Invented the Personal Computer, Co-Founded Apple, and Had Fun Doing It* (New York: W.W. Norton & Company, 2006).

[51] A complete history is found in the following excellent PBS documentary: Michael Cringley, *Triumph of the Nerds: The Rise and Fall of Accidental Empires* (Arlington, VA: Public Broadcasting Service, 1996), http://www.pbs.org/nerds/transcript.html (accessed February 6, 2010).

[52] Dan Bricklin and Bob Frankston founded Software Arts and developed VisiCalc together. They have produced histories of their time with the company: Dan Bricklin, *Software Arts and VisiCalc* (Newton Highlands, MA: Bricklin.com, n.d.), http://www.bricklin.com/history/sai.htm (accessed February 6, 2010); Bob Frankston, *Implementing VisiCalc* (Newton, MA: Frankston.com, 2003), http://www.frankston.com/public/?name=implementingVisicalc (accessed February 6, 2010).



By now, this type of application and its interface should be quite familiar: VisiCalc, 1981.

For the purposes of historical study, however, the significance of the example of VisiCalc lies in its use as a symbol of how the microprocessor revolution changed the way in which individuals accessed computing technology, solving previous market problems while introducing a new set of constraints. In the integration all of the components of a CPU on a single chip, microprocessors reduced the size of computer implementations and thus slashed manufacturing costs while increasing the number of potential applications of computer technology, from cruise missiles to desktop calculators to personal computers. So doing, they removed computers from the closed, capital-heavy environment of the defence industry, major corporations and academia and placed them within reach of the mass, eliminating their former status as privileged, inaccessible goods. From here, private innovators assembled the technology into consumer-oriented platforms that could be purchased in integrated form and used without the high level of technical or engineering expertise that had formerly been required. This resulted in the rise of the personal computer as the premier generative technological environment of this era and the present, as end users could now leverage the open hardware architectures of these systems to develop peripherals and the open software environment of the same to author programs that automated what had formerly been manual tasks. It was no longer necessary to go to Honeywell or UNIVAC or any of the other big, unwieldy integrated solutions providers to process data; similarly, it was no longer necessary to attach oneself to a university or research facility, navigate their bureaucracies to gain access to a computer, compete with other researchers for scarce CPU cycles, or use punch cards to design an algorithm.

The effect of all of this was to break apart certain of the castes of computer operators that had arisen as a result of the economic constraints of the mainframe environment while producing a feedback loop between end-user innovation and systems availability that rapidly increased the size of the personal computer marketplace. The user community of the mainframe era consisted of the major industry players that sold systems, the institutional technical staff that supported them, the innovators who used these systems to design new technologies (predominantly software), and the end users who put the processed data to use.[53] The early microcomputer period saw the amalgamation of the first three classes of users, more often than not people who had worked in the mainframe environment, in the form of inventors who used their technical expertise to develop and use kit computers. The typical microcomputer operator in the mid-1970s needed to know how to solder components, build keyboards, interconnect devices, and then program both the system and applications software that made these computers usable. By the late 1970s these users had formed companies that sold computers as integrated devices, lowering one of the key barriers to use of the technology: one no longer had to assemble a keyboard or a computer by hand. Once these companies gained a foothold in the market, end users themselves could design applications software for a given platform without hardware expertise, and as this software became more useful and available it encouraged the broader adoption of

[53] Franklin M. Fisher, James. W. Mckie and Richard B. Mancke, *IBM and the US Data Processing Industry: An Economic History* (New York: Praeger, 1983).

personal computers. This led to the emergence of the pure, non-expert *user* of technology, that class of consumer that used systems pragmatically, ie. without assimilating the technological errata of a given platform for its own sake. Encouraged by the money that could be made in selling hardware or applications software to this last group, a second-generation set of designers sprung up to cater to this emerging marketplace.

By 1980 the basic form of the personal computer had largely taken shape. It consisted of a motherboard built around a microprocessor from Zilog, Intel or MOS, contained a chipset that provided subsidiary input/output functionality for video, primitive sound (fully digitized audio, wavetable synthesis and the like were still a ways off) and disk access, stored a basic operating system in ROM, and included a keyboard and either expansion slots, expansion ports or both for the connection of manufacturer and third party peripherals.[54] Computer clock speeds, the rate at which a processor evaluates a cycle of instructions, were measured in single megahertz instead of the gigahertz of the present; random-access memory (RAM), the scratch pad used for storing program instructions and variables, was counted in kilobytes instead of the gigabytes of 2010. Software and data files were stored magnetically on floppy disks or cassette tapes whose total capacity was a few hundred kilobytes. The mouse and high-resolution colour graphics had been invented long before, but the limitations of the platforms that arose during this period were such that neither achieved significant adoption until much later in the decade. The preferred mode for the presentation of data was text projected onto

[54] See the list of early-period computer platforms available at old-computers.com: Thierry Schembri and others, eds., "Systems Released in 1980," in *Old-Computers.com* (Carignan de Bordeaux, France: Old-computers.com: n.d.), http://www.old-computers.com/museum/year.asp?st=1&y=1980 (accessed February 10, 2009).

monochrome, phosphor-coated monitors, the ghostly green or orange and black familiar to those who remember the era.[55]

During the same period the overall outline and composition of the market for personal computers took shape. During the early 1980s, dozens of small, medium- and large-sized enterprises introduced their own unique computing platforms, but by 1983 market shake-outs had reduced these to three major offerings: Apple Computer's Apple II (and later Macontish) line of products, Commodore International's wildly successful Commodore 64 (and later Amiga) platform, and the IBM PC. Each of these platforms appealed to different classes of users based on their price points, the market positions of their manufacturers, and the technologies they offered. Apple computers sold most readily to home and educational users who sought a combination of games and productivity software; Commodore, whose platform was relatively inexpensive and offered better graphics and sound capabilities, took the home gaming market by storm; and IBM used its established market presence in the corporate sector to monopolize most of the market for business PCs.[56]

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[55] The timeline provided by the Computer History Museum can be of great assistance in understanding the rapid pace of development within the industry, especially after 1980: Computer History Museum, *Exhibits: Timeline of Computer History* (Mountain View, CA: Computer History Museum, 2006), http://www.computerhistory.org/timeline?category=cmptr (accessed February 10, 2009).

[56] This much can be reconstructed from the platform offerings of these companies during the period and the software base they came to support. The Apple I was emphatically a hobbyist-tinkerer machine, as the end user had to manufacture the computer case and do some electronics design work to assemble the circuit board into a working PC. Apple's early dominance of the home computer market and its relative failure within the business market is made plain by its development of the Apple Lisa, its overpriced and ultimately unsuccessful business-class PC. At an MRSP of $595 in 1981, the Commodore 64 was the cheapest PC offering during the early 1980s, a position it maintained throughout the decade. It also featured the best sound and graphics capabilities until the development of multimedia capabilities on the IBM PC in the early 1990s. As a result, the system came to feature the largest number of games for any personal computer platform until 1990 and, by extension, the most vibrant software piracy scene during the same period. IBM's offering was more expensive than that of its competitors and carried features designed to permit it to interface with its larger IBM mainframe siblings. It was the preeminent development bed for business productivity and database software – indeed, its Monochrome Display Adapter (discussed later) was specifically designed to enable high-quality business text processing.

It was Big Blue's introduction of the IBM PC in 1981 that drove market consolidation by making it more difficult for bit players to establish a toehold and by pushing platforms designed by relatively established competitors like Atari and Tandy Corporation out of the market. Later attempts by Apple to unseat IBM from its dominance in the corporate sphere met with resounding failure, as was the case with the initial quality-control problems that scuttled the Apple III in the eyes of consumers and the exorbitantly-priced Apple Lisa, which sold for $9,995 in 1983.[57] By the middle of the decade, IBM and Commodore held a combined total of 66% of the marketplace, with the remainder mainly held by Apple; by the end of the decade, 80% of all personal computers were either sold by IBM or implemented its architecture.[58]

Regardless of market share or the technical details of specific platforms, the explosive growth of the personal computer industry demonstrates the ultimate viability of the microprocessor as the key technology around which systems could be built. A potential mass market for personal computing technology existed independently of its substrate technologies; it merely had to be discovered, developed and exploited. This was not a matter of breakthroughs in technology, but instead of incremental improvements in manufacturing, marketing, design and price-availability such that the operations of the mass could successfully commoditize the technology in question. As this took place, the level of expertise required to use the devices dropped. Computers became devices that could be bought off the shelf and used without significant training instead of knowledge-privileged goods one had to study in order to use. This tendency

[57] Oldcomputers.net, "Apple Lisa," in *Old Computers* (Orange County, CA: Oldcomputers.net, n.d.), http://oldcomputers.net/altair.html (accessed February 6, 2009).
[58] Jeremy Reimer, "Total Share: 30 Years of Computer Market Share Figures," in *Ars Technica* (New York: Conde Nast Digital, December 14, 2005), http://arstechnica.com/old/content/2005/12/total-share.ars/ (accessed February 10, 2009).

became ever-stronger as personal computers began to appear in homes, small businesses and large corporations: as the market expanded, so too did the pressure on manufacturers to grow this market by reducing or eliminating knowledge-barriers to adoption. The rise of the microprocessor paradigm is thus best explained as the market bypassing a series of constraints, notably the price of data processing and the physical space and capital requirements of the same, and their replacement by a new set of constraints. This allowed certain formerly insoluble problems to be solved and new efficiencies to be exploited while introducing a new set of problems that replaced the old.

IBM PC Dominance: The Rise of the Clones

The IBM Model 5150 Personal Computer, released in 1981.[59]

IBM entered the personal computer market because of fears that its traditional business, which was the design, manufacture and sale of mainframe and minicomputers to corporations, would be outflanked by the rise of personal computers built around the new microprocessors.[60] This threat was made clear by the meteoric success of Apple between 1978 and 1980. As a late entrant, IBM sought to diminish the time required to develop its platform by using

[59] International Business Machines, "IBM Personal Computer – Before the Beginning: Ancestors of the IBM Personal Computer," in *IBM Archives* (Aramonk, NY: n.d.), http://www-03.ibm.com/ibm/history/exhibits/pc/pc_1.html (accessed February 10, 2009). The eye-watering price tags carried by IBM equipment in the late 1970s -- $9,340 to $23,990 for the IBM 5120 – underline the threat posed by Apple and company.
[60] Robert S. Sobel, *IBM vs. Japan: The Struggle for the Future* (Briarcliff Manor, NY: Stein and Day, 1986), 175-194.

off-the-shelf components and contracting out the design of operating system software to other companies.[61] The IBM PC used the Intel 8088 microprocessor, a 16-bit design that could address one megabyte of random-access memory, then an unheard-of amount in an environment dominated by 8-bit machines that could only address 64 kilobytes of RAM.[62] IBM's initial choice of operating system was CP/M, which had been designed by Digital Research Inc., of California and was typically used on computers produced by companies other than Commodore or Apple, who wrote their own operating systems for use with their hardware.[63] When licensing negotiations with Digital Research proceeded more slowly than desired, however, IBM struck an agreement with Bill Gates' Microsoft to license MS-DOS (the Microsoft Disk Operating System) for use on the platform.[64] This itself was a re-branded version of Tim Paterson's 86-DOS, then owned and marketed by Seattle Computer Products. Microsoft purchased the complete rights to the software in 1981 and subjected it to slight internal modifications prior to releasing it with the IBM PC.[65]

While using off-the-shelf components and a third-party operating system allowed IBM to get its system out the door that much faster, it also placated antitrust investigators. In 1969, the Department of Justice filed a lawsuit against the company over its allegedly monopolistic business practices. The litigation of this suit ran continuously between

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[61] International Business Machines, "The Birth of the IBM PC," in *IBM Archives* (Aramonk, NY: n.d.), http://www-03.ibm.com/ibm/history/exhibits/pc25/pc25_birth.html (accessed February 10, 2009); International Business Machines, "IBM Personal Computer," in *IBM Archives* (Aramonk, NY: n.d.), http://www-03.ibm.com/ibm/history/exhibits/pc/pc_1.html (accessed February 10, 2009).

[62] In reality, the 8088 was a variant of the Intel 8086 that used an 8-bit external bus. Memory addressing was unchanged. See Gennaidy Shvets, "Intel 8088 Microprocessor Family," in *CPU-World.com* (Fairfax, VA: Cpu-World.com: n.d.), http://www.cpu-world.com/CPUs/8088/ (accessed February 10, 2009).

[63] Herbert R. Johnson, *CP/M and Digital Research Inc., (DRI) History*, (New Jersey: Retrotechnology.com, 2010, http://www.retrotechnology.com/dri/d_dri_history.html (accessed February 10, 2009).

[64] Leven Anatoy, "Short History of MS-DOS," in *Skrause.org* (Madison, WI: Skrause.org, 1996), http://www.skrause.org/computers/dos_history.shtml (accessed February 10, 2009).

[65] Tim Paterson, "A Short History of MS-DOS," in *Byte* (June, 1983), http://www.pattersontech.com/Dos/Byte/History.html (accessed February 10, 2009).

when process was initiated and when it was resolved via *mandamus* in the mid-1980s.[66] By using non-IBM-manufactured hardware and software components, IBM was able to claim that it was not seeking to stifle competition in the PC marketplace through vertical integration.[67] IBM also published the technical specifications of much of the system in an attempt to encourage the development of a market for third-party peripherals and software applications. This demonstrated a keen understanding of what had made Apple's personal computer offering so successful, namely permitting end users to define the set of problems that could be solved by the system and design the means to do so. IBM's licensing agreement with Microsoft was non-exclusive, meaning that Microsoft could sell its operating system with systems other than the IBM PC, but IBM executives held that this concession was insignificant as they believed they could control their segment of the PC market through a combination of hardware sales, patent exclusion, and the force of the brand.[68]

In the end, this proved short-sighted – for IBM, that is. The market penetration figures provided above are misleading because of the reasons for the success of the IBM PC platform, namely the fact rival manufacturers began producing 100% IBM PC-compatible clone computers at less than the price of IBM's offerings. Initial adoption of the IBM PC was driven by the platform's own VisiCalc, which came in the form of Lotus Software's Lotus 1-2-3 spreadsheet application, but credit for the eventual dominance of

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[66] Rachel Konrad, "IBM and Microsoft: Antitrust Then and Now," *CNet News*, June 7, 2000, http://news.cnet.com/2100-1001-241565.html (accessed February 12, 2009). *United States v. International Business Machines Corp.*, 69 Civ. 200 (S.D.N.Y., filed January 17, 1969).
[67] Gerald Boerner, "Network Profile of the Day: The IBM PC, Part 1," in *Prof. Boerner's Explorations* (blog), March 17, 2010, http://www.boerner.net/jboerner/?p=9758; J. Dedrick and K. L. Kramer, "Behind the Curve: Japan's PC Industry," in *Global Business 1995*, http://www.crito.uci.edu/papers/1996/global_bus_article.pdf (accessed 17 July 2010).
[68] James Wallace, *Hard Drive: Bill Gates and the Making of the Microsoft Empire* (New York: Wiley, 1992).

the platform must go to the clones.[69] The use of off-the-shelf components, non-exclusive operating system licensing agreements and wide publication of the technical specifications of the system made it possible for firms to engineer computer systems that replicated the IBM design without duplicating it to the point of patent infringement. The market for PC clones exploded once the only true piece of proprietary hardware in the system, the IBM BIOS (basic input/output system, a traffic cop for hardware) was duplicated through clean-room reverse-engineering.[70] The first companies to accomplish this feat were Columbia Data Products and Compaq Computers for use in their own PC-compatible systems, but shortly thereafter Phoenix Technologies of Boston began producing a PC-compatible BIOS that could be bought and used by any manufacturer. This effectively commoditized the IBM PC platform, leading to a sizeable increase in the number of clone manufacturers and aftermarket hardware vendors. What came to dominate the market was thus not the branded IBM PC as such, but instead the platform defined by the specifications of the original system.

But why did clone manufacturers seek to copy IBM's design in the first place? Simply put, the status of IBM as the major purveyor of business automation technology, its deep pockets and its advertising prowess made it a market-maker. The corporate world trusted staid, stable IBM and proved willing to adopt its platform; makers of clones could thus ride to profitability on the coattails of the giant and, once IBM branding had become conceptually disaggregated from the concept of the PC, compete on price or technical prowess. This became true far more quickly than anyone could have

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[69] Martin Campbell-Kelly, interviewer, *An Interview with Johnathan Sachs* (Minneapolis, MN: Charles Babbage Institute Collections: 2004), http://www.cbi.umn.edu/oh/pdf.phtml?id=340 (accessed February 20, 2009), 6-20.

[70] Paul D. Cook, Alan McCoy and others, "PC History – December 10," in *Macintouch* (Maynard, MA: Macintouch.com, 2004), http://www.macintouch.com/pchistory.html#dec10 (accessed February 20, 2009).

anticipated: in 1982, Compaq introduced the first portable PC-compatible; in 1986, the same company beat IBM by bringing the first PC-compatible built around the cutting-edge Intel 80386 processor to market; and by 1987, the "gang of nine" major PC clone manufacturers had begin devising their own interconnect standards for use with PC-compatible systems.[71] The IBM PC hardware specification was thus gradually superseded by the x86 (so named after Intel's 8086/80286/80386/80486 line of processors) architecture, to which most microcomputers – even offerings from Apple – conform to this day.

In the end, IBM's loss of control over the PC market proved far less of a defeat than it seemed at the time. System components other than the BIOS were covered by patents, and clone manufacturers wound up paying rich royalties to Big Blue to duplicate those aspects of the system, like the ISA bus, which every clone system had to adopt to maintain true IBM PC compatibility. Conceding that it had been partially outflanked by clone manufacturers, IBM returned to doing what it did best in this market segment: selling computers on the value-added bases of excellent build quality and customer support. Ultimately, the historical significance of IBM's entrance into the personal computer market is twofold. First, through the force of its reputation and its corporate clout, IBM's entry into the market drove personal computer adoption by big business while demonstrating that microcomputers were no mere flash in the technological pan. It was the personal computer that made automated data processing ubiquitous, and in the main it was IBM that "made" the personal computer. This was done not by deploying technology radically different from that of the other market players, but merely by making it an accessible and "safe" choice for consumers. Second (and more importantly

[71] The "gang" consisted of AST, Compaq, Epson, HP, NEC, Olivetti, Tandy, Wyse and Zenith.

to the subject of this paper), mass adoption of the IBM PC platform encouraged the development of novel forms of expression – like ANSI, the art form that arose in the comingling of microcomputer and networking technology that came to be known as the digital underground. Few people like to perform without an audience for their work, and IBM's market-making activity ensured that just such an audience existed.

Ma Bell and Modems: Network History through to the 1980s and Early 1990s

Throughout the period under study, the only consumer-accessible communications network was the public switched telephone network (PSTN). Leaving aside recent developments like mobile phones and voice-over-IP (VOIP), the technological and business conventions of this network have only marginally changed since the middle of the twentieth century, when electromechanical switching, the North American Numbering Plan and Direct Distance Dialling came into vogue.[72] Standard analog telephones are connected to phone company central offices by copper wires, with two wires (ring and tip) comprising a circuit. Area codes slice larger market areas into manageable, geographically-bounded chunks of ten million customers or fewer, Local Exchange Carriers (LECs) charge for both basic telephone service and long distance, frequently metering both by the minute, and the market remained dominated by monopoly players until government antitrust divestiture initiatives broke up the national colossi into smaller regional players.[73] These monopolies originally developed through patent exclusion, but

[72] *About the North American Numbering Plan* (Sterling, VA: Neustar Inc., 2010), http://www.nanpa.com/about_us/abt_nanp.html (accessed July 14, 2010); AT&T Labs, "1951: First Direct-Dial Transcontinental Telephone Call," in *AT&T Labs Technology Timeline* (Florham Park, NJ: AT&T Labs, 2010), http://www.corp.att.com/attlabs/reputation/timeline/51trans.html (accessed June 10, 2010); G. E. Schindler, ed., *Switching Technology, 1925-1975* (New York: Bell Telephone Laboratories, 1982).
[73] Richard R. John, *Network Nation: Inventing American Telecommunications* (Cambridge, MA: Harvard University Press, 2010).

once the basic Bell patents expired AT&T sought sanctioned monopoly status as its route to long-term viability. To government, this was an eminently sensible arrangement: like other businesses that require infrastructure investment on the scale and model of public utilities, it made little sense to encourage competitors to wire the same area twice; ruinous competition could disrupt the potential for universal service, a mantra devised by AT&T and eagerly adopted by regulators; and stability was more important than choice when the infrastructure in question was so vital to both economic productivity and national security.[74]

Telecommunications is nothing more than the sending of information over distances greater than the line of sight.[75] The form of the information sent, be it voice or data, is a function of marketplace demand and the limitations of the available technology of a given period; these define the information density of the transmission medium and thus its relative efficiency. In the beginning, the North American telecommunications network was designed to carry data. This was the era of the telegraph, with operators at each end of the connection taking written text, sending it down the wire in the form of keyed pulses and then converting the pulses back into text at the remote end.[76] This was adequate for short, unidirectional messages, but the information density of the telegraph was low, the speed of transmission (a function of the intermediaries required to transmit and decode a message) was slow, the overall market penetration of telegraph devices was similarly low, concentrated as it was not in the homes of individual users but within the

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[74] Robert W. Garnet, *The Telephone Enterprise: The Evolution of the Bell System's Horizontal Structure, 1876-1909* (Baltimore, MD: The Johns Hopkins University Press, 1985); Peter Temin, *The Fall of the Bell System: A Study in Prices and Politics* (Cambridge: Cambridge University Press, 1987), 9-70.
[75] Horizon-to-horizon signal fires have existed since time immemorial, but until the discovery of electricity, the line-of-sight semaphore tower was king: J-M Dilhac, *The Telegraph of Claude Chappe – An Optical Telecommunication Network for the XVIIth Century* (Toulouse: Institute National des Sciences Appliquées, n.d.), http://www.ieeeghn.com/wiki/images/1/17/Dilhac.pdf (accessed May 15, 2010).
[76] R. N. Renton. *Telegraphy* (London: Pittman, 1976).

corporate offices of those entities that operated the networks, and the price per unit of data was comparatively high when viewed against subsequent technologies.[77]

Chief amongst these was the telephone, the first technology that placed networked communications within the immediate, quotidian grasp of typical consumers. In terms of their back- and front-office operations, telephone networks initially operated much like the telegraph networks they would eventually supersede: the placing of calls demanded communication with a human intermediary in the form of an operator that would ring remote stations and establish the communications channel.[78] What differed was that the capital required for this communication, at least from the perspective of the end user, was concentrated within private businesses and households. Access to the network was limited not by the availability of centralized telegraph offices from which cables could be sent, but instead the installation of individual phone handsets in the home and the connection of these handsets to a central exchange. Subject to the capital requirements of laying cable and erecting switching offices – in this the cost-shaving example of the rural "party line" telephone connection comes to mind – the deployment of telephone technology allowed local carriers to enhance revenues by accessing a mass market, in the process commoditizing the technology.[79]

When compared to the telegraph, whose receive-only tickers existed only in the private residences of a minority of stockbrokers, financial tycoons and captains of industry, the advantages of the telephone were immediately obvious. The rate of

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[77] Robert Luther Thompson, *Wiring a Continent: The Telegraph Industry in the United States, 1832-1866* (Princeton: Princeton University Press, 1947).

[78] Herbert N. Casson, *The History of the Telephone* (Middlesex, UK: The Echo Library, 2007); Far more interesting is Claude S. Fischer, *America Calling: A Social History of the Telephone to 1940* (Berkeley: University of California Press, 1992).

[79] Alvin Von Auw, *Heritage and Destiny: Reflections on the Bell System in Transition* (New York: Praeger, 1983), 35-43.

transmission was much faster, as it was limited by speech instead of how quickly an operator could key in Morse; the data density was naturally much higher, as it captured both verbatim speech and all of the subtle cues contained in cadence, tone and choice of language; the privacy of communications was enhanced, subject only to the eavesdropping of telephone operators (the development of modern cryptography owes much to the public nature of telegraph offices); and, as stated previously, the initiation and reception of the communications themselves became a matter of private, point-to-point control. On the back of generous government subsidies in the form of tax and market monopoly concessions and the development of cheap carbon microphones, the telephone quickly became the dominant medium of local private information interchange in major urban centres across North America.[80]

The first significant overlap between the development of the telephone and computer industries took the form of automated electromechanical switching systems. A key limiter on the widespread deployment of telephone technology (and not coincidentally, its profitability) was the human capital required to connect circuits. This was addressed by the development of the step-by-step (SxS) and rotary telephone switching systems in the 1920s and 30s and the crossbar (1XB) system in the 1950s, which used electrical dialling pulses to guide switch contacts to the correct circuit.[81] These were not true computing devices in the Turing-complete sense of the word, but they allowed for the replacement of manual circuit board operators with electronic

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[80] Milton L. Mueller Jr., *Universal Service: Competition, Interconnection, and Monopoly in the Making of the American Telephone System* (Cambridge, MA: The MIT Press, 1997); Gerald R. Faulhaber, *Telecommunications in Turmoil: Technology and Public Policy* (Cambridge, M.A.: Ballinger Publishing Company, 1987), 1-17.
[81] AT&T, "History of Network Switching," in *History of the AT&T Network* (Dallas, TX: AT&T, n.d.), http://www.corp.att.com/history/nethistory/switching.html (accessed June 10, 2010); Richard A. Thompson, *Telephone Switching Sytems* (Boston: Artech House, 2000).

devices that could serve requests tirelessly and connect calls without error. International and intra-national long-distance calls still required some operator intervention until the advent of International Direct Distance Dialling (IDDD) in the 1970s. During the same period, dual-tone multi-frequency (DTMF, "tone") dialling came into vogue along with Centrex services, telephone company line features that successfully emulated the function of customer-sited private branch exchange (PBX) switching systems. These last innovations depended on the successful commoditization of microprocessor technology, as they demanded the flexibility of control functions running in software – essentially the Stored Program Control Exchange that was the foundation of contemporary Electronic Switching Systems (ESSs), notably the 5ESS of AT&T.[82]

Computing technology was not simply used to connect calls, however. A perennial problem that acted as one of the most fertile development beds of automated data processing technology lay in the coordination of telephone back-office operations, from line subscription to feature installation to accounting and billing. SERVORD, the SERvice ORDering system commonly used in the United States and Canada on telephone switches manufactured by Bell/Lucent and NorTel, allowed for the automatic provisioning of Directory Numbers (DNs). Protocols still in widespread use on the Internet and in intranet authentication schemes, notably the Lightweight Directory Access Protocol (LDAP) used to do white pages-style lookups of subscriber information, had their origins in the wedding of back office functions and computers.[83] The UNIX family of operating systems, of which Linux is the most prominent contemporary member, was

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[82] J. E. Flood, ed., *Telecommunication Networks,* Second Edition (London: The Institute of Electrical Engineers, 1997), 135-56.

[83] Lee Dryburgh, *Signalling System No. 7 (SS7/CC7): Protocol, Architecture, and Services* (Indianapolis, IN: Cisco, 2005); John C. McDonald, ed., *Fundamentals of Digital Switching* (New York: Plenum Press, 1990).

initially developed by AT&T through contracts with academic partners to provide a modern, mainframe-capable multitasking operating system for use in both general purpose and telecommunications-specific applications.[84] Eventually all telecom functions were controlled by computers and the role of human operators in the system was minimized almost to the point of invisibility, a development that began in earnest with AT&T's deployment of the Traffic Service Position System (TSPS) in 1969.[85]

The effect of the application of computing technology – first mechanical, then later digital – to telecommunications stands as yet another example of a revolution of commoditization that changed the consumer marketplace. Combining telephone technology with computer automation changed distance communications into an inexpensive commodity that could be accessed by the mass. [86] The distinction between mass adoption of the microcomputer and mass adoption of telecommunications, however, is defined by the fact that users of the latter access a network (hence *service*) provided by another party rather than directly owning all of the required infrastructure themselves. That said, hobbyist interest in the telephone system equivalent to both microcomputer adopters and earlier radio and hi-fi enthusiasts developed as telecoms technology reached an ever-larger market, the electronic components (transistors, capacitors, relays and the like) required to assemble home-built telephone devices dropped in price, and certain

[84] "UNIX: Past History and Timeline," in *The Open Group* (Reading, UK: The Open Group, January 29, 2003), http://www.unix.org/what_is_unix/history_timeline.html (accessed accessed March 4, 2010); Peter H. Salus, *A Quarter Century of UNIX* (New York: Addison-Wesley, 1994).
[85] Tom Fanley, "TSPS History," in *Private Line* (West Sacramento, CA: Privateline.com, n.d.), http://www.privateline.com/circuits/TSPS_history.htm (accessed March 4, 2010).
[86] David A. Mindell, *Between Human and Machine: Feedback, Control and Computing Before Cybernetics* (Baltimore, MD: The Johns Hopkins University Press, 2002), 105-137; John R. Pierce, "The Telephone and Society in the Past 100 Years, in *The Social Impact of the Telephone*, ed., Ithiel de Sola Pool (Cambridge, MA: The MIT Press, 1977), 159-199; also Colin Cherry, "The Telephone System: Creator of Mobility and Social Change," same volume, 112-126.

regulatory constraints governing private use of the network weakened.[87] The popularization of the integrated circuit meant that there was more than one way to access the network: in a pattern identical to the diffusion of microprocessor and computer technology from its privileged sanctuaries in academia, the defence industry and big business, phone hobbyists working within the industry acted as conduits through which phone-based computer networking technology gradually became available to private individuals.

The technology required to send digital data down telephone lines had existed at least since the SAGE system described earlier and was a natural extension of teletype systems that sent text messages down dedicated circuits in Baudot code.[88] What distinguished modern modems from their predecessors was the fact that they used modulated sound sent over the voice circuit instead of requiring dedicated data lines of their own. This meant that networking technology became nominally circuit-independent: the same telephone line could carry both voice and data, though not simultaneously, and did not require a complex custom installation to support the required subscriber equipment.[89] The use of the acoustic channel thus held open the possibility of private, point-to-point digital communications, as both the network and the technology existed at a sufficient level of maturity to support a mass market. What was missing was

[87] The best example of the relationship between component price cuts, telephone systems tinkering and, conveniently, hacker culture is Ron Rosenbaum's October, 1971 *Esquire* article detailing the use of hobbyist-built "blue boxes" (in-band telephone signalling devices that permitted toll fraud). Ron Rosenbaum, "Secrets of the Little Blue Box," *Esquire* (October, 1971), http://www.historyofphonephreaking.org/docs/rosenbaum1971.pdf (accessed March 2, 2011).
[88] R. A. Nelson and K. M. Lovitt, eds., *History of Teletypewriter Development* (Skokie, IL: Teletype Corporation, 1968).; Robert N. Renton, *The International Telex Service* (London: Pittman, 1974).
[89] P. R. D. Scott, *Modems in Data Communications* (Manchester: NCC Publications, 1980); given its year of publication, this source is as significant as a primary document as it is a secondary source. For a more comprehensive, recent, and mathematically-oriented guide, see Richard E. Blahut, *Modem Theory: An Introduction to Telecommunications* (Cambridge: Cambridge University Press, 2010).

sufficient consumer adoption of computing devices such that users had something to connect *to* and a network of hobbyist-enthusiasts that could both serve as a market for consumer modem technology and as developers of the same. The microcomputer revolution supplied both, though none of this would have been possible had AT&T maintained its regulatory monopoly on the kinds of devices that could be connected to its network. Without the landmark court cases of *Hush-a-Phone v. United States* and *Carterfone v. AT&T*, in which Ma Bell was ordered to allow the direct connection of compatible telephone devices to AT&T phone lines provided they met certain technical requirements, the meteroric rise of the modem might not have happened at all.[90]

AT&T had little interest in selling modems to a consumer market that did not yet exist, so it is unsurprising that the first consumer-grade models to hit the scene were hobbyist-designed clones of the Bell 103 design originally introduced in 1962. The modem did not truly hit the mainstream until the release of Novation's AppleCat and other Cat-series modems in the late 1970s, which as the name of the first suggests, was designed exclusively for the Apple series of personal computers. The AppleCat's primary application was in transferring files from user to user via its proprietary Catsend and Catfur protocols, but consumer adoption of the device was limited by its high price and the fact that it had to be plugged directly into the motherboard of a compatible Apple computer to automatically answer calls.[91] Connection to an internal bus to perform this function was required as most modems used acoustic couplers to connect to the phone network and no manufacturer had devised a standardized way to signal to a modem that it

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[90] *Hush-a-Phone v. United States* (1956), 99 U.S. App. D.C. 190, 238 F 2d 266 (D.C. Cir); *Carterfone v. AT&T* (1968), 13 F.C.C. 3d 420, 13 Rad. Reg 2d (P & F) 597.

[91] For a thorough treatment of the capabilities of the Novation Cat family of devices, see James W. Abendschan, "The Novation AppleCat][," in *James W. Abendschan's Home Page* (Portland, OR: Jammed.com, n.d.), http://www.jammed.com/~jwa/Machines/cat/ (accessed June 5, 2010).

should pick up the phone, dial, or disconnect a call. Call setup thus typically involved the computer user manually dialling a telephone number before placing the handset of a nearby telephone in the modem's cradle – hardly an ideal process – and modems themselves consisted of cheaper call-only models and more expensive host-side boxes that could answer calls on their own. The need for hardwiring also made modem implementations platform-dependent, with different manufacturers marketing models for each family of microcomputers.

The natural answer to this sort of platform dependence was the SmartModem, originally designed by Dennis Hayes in his kitchen and later marketed by a titan of the 1970s and 1980s computer industry, his eponymous Hayes Microcomputer Products. By siting modem hardware in an external device connected via the standard RS-232 port provided by most microcomputers and developing a series of standard commands (AT-commands) that allowed a computer to tell the modem what to do, Hayes made the modem a platform-independent device, eliminated the distinction between call-only and call-answering modems, turned end-user setup into a matter of connecting standard cables rather than hardwiring, and reduced the high cost associated with running a dial-in system. So doing, he drove most early modem manufacturers out of the market, devised a control sequence standard for serial modem communications that exists to this day, and created a mass market for the devices.[92]

[92] After the development of the SmartModem, essentially all serial modems were advertised as "Hayes-compatible," meaning they spoke the Hayes AT command set. The standard was eventually adopted by the International Telecommunications Union as a V-Series recommendation in 1995. For the most recent revision, see International Telecommunications Union, *V.250: Serial Asynchronous Automatic Dialling and Control* (Geneva: International Telecommunications Union, July, 2003), http://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-V.250-200307-I!!PDF-E&type=items (accessed March 2, 2011).

By this point, the reader should be able to predict the trajectory of Hayes' career: he began by working in academia, specifically at the Georgia Institute of Technology, before jumping to National Data Corporation, a private-sector company that specialized in deploying payment processing solutions for business.[94] Hayes leveraged the information he gathered performing modem installations at customer sites to design the products he eventually sold through his company, in the process bridging the gap between the institutional, commercial and consumer markets and the spheres of knowledge- and price-accessibility that separated these segments of the economy. He was successful because he operated within a market environment in which the commoditization of technology had reached a point where end-users could combine their technical expertise with their perception of emergent problems generated by the limitations of this market, in the process creating new industries whose target was consumers instead of industry or government. In other words, he was the kind of hobbyist market-popularizer of technology very much in the mould of the microcomputer

Industry-maker: the Hayes Smartmodem 300.[93]

[93] James Grahme, "Getting Online: The Hayes Smartmodem," in *Retrothing: Vintage Gadgets and Technology* (Calgary, Alberta: Retrothing.com, March 27, 2009), http://www.retrothing.com/2009/03/hayes-smartmodem.html (accessed December 10, 2009).

[94] To my knowledge, the Hayes Microcomputer Products has not been the subject of a proper academic history. See "Hayes Corporation" in *Answers.com: The World's Leading Q&A Site* (Jerusalem: Answers.com, n.d.), http://www.answers.com/topic/hayes-corporation (accessed April 4, 2010); also "Dennis C. Hayes," in *The Great Idea Finder* (Troy, MI: Ideafinder.com, 2007). http://www.ideafinder.com/history/inventors/hayes.htm (accessed March 2, 2011).

pioneers that preceded him.

The Bulletin Board System

With the hardware needed to connect two computers over the telephone network available, a simple question presented itself: what could one connect *to?* Given the constraints inherent in the design of microcomputer systems – their relatively slow processors and limited memory and storage capacity – the initial application of the consumer-grade modem lay in providing a means whereby microcomputer users could connect to larger minicomputer and mainframe systems.[95] Indeed, the serial line protocols used by microcomputer modem applications had originally been developed to permit the installation of remote terminals linked to these same mainframes, a fact that explains why early dialling programs sought to replicate the screen-control and input routines used by terminals like Digital Equipment Corporation's VT-52 and VT-100 through terminal emulation.[97] The do-it-yourself culture of microcomputer hobbyists would not long permit enthusiasts to be satisfied with

DEC VT-52 Terminal, 1974.[96]

[95] See, as an example, the technical specifications of DEC's popular PDP-11 mainframe, and its eventual packaging inside the VT-100 terminal: Ed Thelen, "PDP-11" in *Facts and Stories About Antique (lonesome) Computers* (Fremont, CA: Ed-Thelen.org, September 13, 2004), http://ed-thelen.org/comp-hist/pdp-11.html (accessed June 6, 2010). A link to the DEC PDP-11 systems manual is available on the site. For the IBM side of things, notably the still-in-use 3270 terminal standard, see Klaus Brandstaetter, "3270: A Brief History," in *HOB Techtalk* (blog), September 12, 2008, http://www.hob-techtalk.com/2008/09/12/3270-a-brief-history (accessed June 6, 2010).

[96] Wayne Carlson, "Section 3: The Computer Graphics Industry Evolves," in *A History of Computer Graphics and Animation* (Columbus, OH: Ohio State University, 2003), http://design.osu.edu/carlson/history/lesson3.html (accessed June 4, 2010).

[97] Paul Williams, "Meet the Family," in *VT History* (Crawley, UK: vt100.net, 2006), http://vt100.net/vt_history (accessed June 6, 2010).

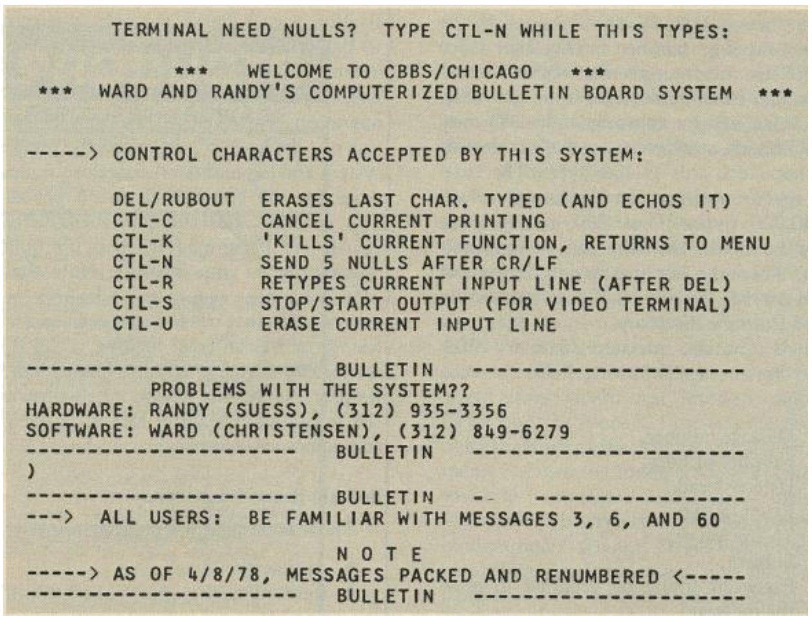
dialling up to mainframes or maintaining their dependency on the indulgence of big business, big government or big academia, however: they desired their own systems, mainly to act as an extension of the dozens of computer users groups that had sprung up in the market churn of the microprocessor revolution.

Beginning on Tuesday, January 24, 1978, the Chicago area experienced a period of the lowest atmospheric pressure ever recorded in the mainland United States, the beginning of a massive blizzard that dumped nearly five feet of snow on the city by the end of the week. The effects of this storm, the so-called Great Blizzard of 1978, were felt as far north as south-western Ontario – Sarnia, London and Toronto reported equivalent record-breaking lows in atmospheric pressure coupled with equivalent record-breaking snowfalls. Commerce was paralyzed; whole cities ground to a halt; in Ohio and Michigan, over 70 people died as a result of the extreme weather.[98] But overlooked in the carnage caused by innumerable traffic accidents, turnpike closures and shovelling-induced heart attacks is the fact that Ward Christensen and Randy Suess, two members of the Chicago Area Computer Hobbyists' Exchange (CACHE) used the much-needed downtime to cobble together CBBS, the world's first computer bulletin board system.[99] Christensen had previously developed MODEM, a serial-line file transfer protocol that permitted the exchange of binary information between two hosts connected to the telephone network. The storm allowed Christensen to start writing the CBBS software and Suess to assemble a S-100-based computer (recall that this data bus made its first

[98] Thomas W. Schmidlin and Jeanne Applehans Schmidlin, *Thunder in the Heartland: A Chronicle of Oustanding Weather Events in Ohio* (Kent, OH: Kent State University Press, 1996). Illinois seems to have escaped their notice.
[99] Ward Christensen and Randy Suess, "The Birth of the BBS," in *Chinet – Public Access Since 1982* (Chicago, IL: Chinet.com, 1989), http://www.chinet.com/html/cbbs.html (accessed July 5, 2008); Chris Gilbertson, "This Day in Tech, February 16, 1978: Bulletin Board Goes Electronic," in *Wired* (New York: Condé Nast, February 16, 2010), http://www.wired.com/thisdayintech/2010/02/0216cbbs-first-bbs-bulletin-board (accessed June 19, 2010).

appearance with the popular Altair 8800 microcomputer) upon which the software would run. By February 16th, the system was live, and in November of the same year the two designers showcased their invention in an article published in *Byte Magazine.*

What exactly is a BBS? Christensen and Suess were enamoured of the idea of an automated, computer-to-computer telephone answering service that would allow them to publicize upcoming CACHE meetings and serve as a site of digital information interchange for hobbyist developers.[101] The name itself drew its inspiration from the then-ubiquitous message boards, slotted or corkboard walls installed in grocery stores to allow customers to post index or business cards advertising local services and events. The format is one intimately familiar to any user of the modern Internet: web-based boards allow users, identified by nicknames, to post messages in "forums" devoted to particular topics. Later, BBSes began to offer file libraries, online gaming, and their own peculiar implementation of



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        TERMINAL NEED NULLS?  TYPE CTL-N WHILE THIS TYPES:

              ***   WELCOME TO CBBS/CHICAGO   ***
 ***  WARD AND RANDY'S COMPUTERIZED BULLETIN BOARD SYSTEM  ***

-----> CONTROL CHARACTERS ACCEPTED BY THIS SYSTEM:

        DEL/RUBOUT  ERASES LAST CHAR. TYPED (AND ECHOS IT)
        CTL-C       CANCEL CURRENT PRINTING
        CTL-K       'KILLS' CURRENT FUNCTION, RETURNS TO MENU
        CTL-N       SEND 5 NULLS AFTER CR/LF
        CTL-R       RETYPES CURRENT INPUT LINE (AFTER DEL)
        CTL-S       STOP/START OUTPUT (FOR VIDEO TERMINAL)
        CTL-U       ERASE CURRENT INPUT LINE

----------------------    BULLETIN    ----------------------
           PROBLEMS WITH THE SYSTEM??
HARDWARE: RANDY (SUESS), (312) 935-3356
SOFTWARE: WARD (CHRISTENSEN), (312) 849-6279
----------------------    BULLETIN    ----------------------
)
----------------------    BULLETIN    --    ----------------
--->  ALL USERS:  BE FAMILIAR WITH MESSAGES 3, 6, AND 60
                          N O T E
-----> AS OF 4/8/78, MESSAGES PACKED AND RENUMBERED <-----
----------------------    BULLETIN    ----------------------
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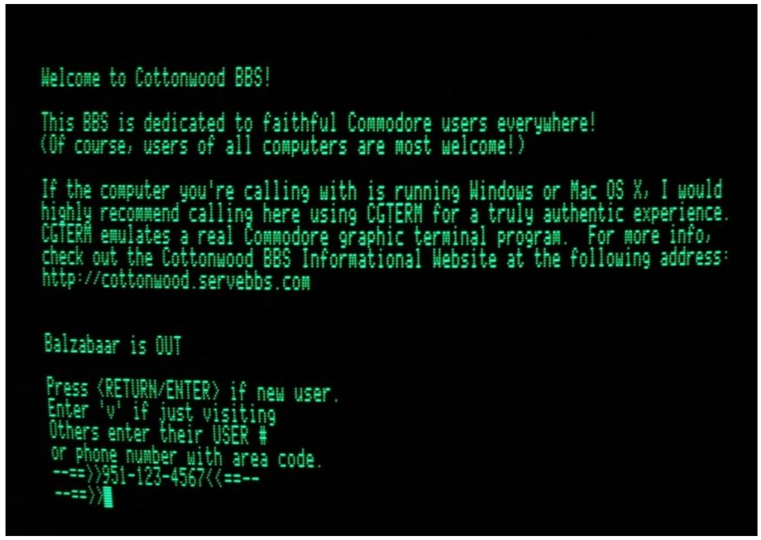
CBBS in action: screen printout from Suess and Christensen's article in Byte Magazine.[100]

[100] Ward Christensen and Randy Seuss, "Hobbyist Computerized Bulletin Board," in *Byte* 3, issue 11 (November, 1978), http://vintagecomputer.net/cisc367/byte%20nov%201978%20computerized%20BBS%20-%20ward%20christensen.pdf (accessed June 20, 2010).

[101] Michael Swaine, "History Lesson: Ward Christensen's Free Free-Exchange Software," in *InfoWorld* (November, 1982), http://books.google.ca/books?id=EzAEAAAAMBAJ&pg=PA26&lpg=PA26 (accessed March 2, 2011).

networked mail and messaging. As they became increasingly pressured by Internet Service Providers in the mid- to late nineties, they provided email, Usenet newsgroups, and eventually full Internet access via the modem-backed Serial Line Internet Protocol and Point to Point Protocol (SLIP / PPP).



Standard login screen of a Commodore 64 BBS, "Cottonwood," running All American BBS software. It is still in operation. The phosphorescent green-on-black display and reliance on text mode as a means of presenting an interface is typical of microcomputer BBSes of the early 1980s. In this case, the terminal used is an Apple IIe. [103]

Contemporary computer systems sport full-colour, high-resolution displays and take the graphical user interface (GUI) as the *sine qua non* of user interaction with running software. Bitmapped and vector-based graphics and pointing devices – mice – allow users to perform operations by clicking on buttons or other user interface widgets. This was not the dominant mode of user-system interaction until at least the early 1990s, though antecedents could be seen in the Xerox Star system, released in 1981, and in the first Apple Macintosh computer.[102] Given the constraints on both the hardware of early microcomputer systems and the speed at which data could be sent down the line, bulletin

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[102] Eric S. Raymond, "The First GUIs," in *The Art of Unix Usability* (Chapel Hill, NC: Catb.org, 2004), http://www.catb.org/~esr/writings/taouu/html/ (accessed June 20, 2010). A collection of primary documents pertaining to the Star system has been assembled by Dave Curbow, "Xerox Star Historical Documents," in *DigiBarn Computer Museum* (Santa Cruz, CA: Digibarn.com, 2004), http://www.digibarn.com/friends/curbow/star/index.html; Apple Computer, *Macintosh Selling Guide* (Cupertino, CA: Apple Computer, 1984), http://archive.computerhistory.org/resources/text/Apple/Apple.Macintosh.1984.102646178.pdf (accessed June 20, 2010).

[103] Quag7, "Using an Apple II as a Serial Terminal with Gentoo Linux," in *Dataswamp.net* (Marana, AZ: Dataswamp.net, July 4, 2007), http://www.dataswamp.net/apple2eserialterm (accessed June 4, 2010).

board systems operated in text mode, typically with a resolution of 80 by 25 plain-text characters displayed on a monochrome monitor. Interaction with these systems took place using a keyboard alone, with menu "hotkeys" (one would press "F" for files, as an example) giving access to different parts of the system. Because bulletin board systems relied on the circuit-switched telephone network as their means of communication, only one user could access the system at a time. Their popularity meant that system operators implemented per-user daily time limits, typically of sixty minutes or less. Later, as the BBS world came to comprise commercial systems as well as those run by hobbyists and the cost of communications came down, multi-node systems and systems which were funded in part or in whole by user subscription fees began to appear in markets big enough to support them.[104] These were many, as before the rise of the Internet (and leaving aside the exception of nation-wide network services like CompuServe and Genie, which were quite expensive), bulletin board systems were the sole means by which computer users in a local area could interact with each other electronically and share files.[105]

Part of the historical uniqueness of the bulletin board system rests with its status as the first widely-available, organically organized, anonymous electronic community. While the advent of digital telephone switch services – Caller-ID foremost amongst them

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[104] Exec-PC, as an example, had over 250 nodes at its peak: Matt Ritchel, "Bit Players," in *Wired 6.08* (New York: Condé Nast, August, 1998), http://www.wired.com/wired/archive/6.08/es_access.html?pg=1 (accessed December 8, 2009); Bob Metcalfe, "From the Ether: Sysops are Reaping the Benefits in the Wake of a BBS Explosion," in *InfoWorld 16*, iss. 36, September 5, 1994, http://books.google.ca/books?id=XDgEAAAAMBAJ&lpg=PA52&ots=EQr2cTkKUM (accessed July 6, 2010): 52.

[105] Ironically, the hobbyist invention of the BBS preceded corporate online offerings to the general public by a few years: David Carlson, "The Online Timeline: Compuserve," in *David Carlson's Virtual World* (Gainesville, FL: University of Florida College of Journalism, 2009), http://iml.jou.ufl.edu/carlson/history/compuserve.htm (accessed July 6, 2010); William Louden, "Remarks by William Louden, General Manager, GEnie" (Keynote address, ENA Conference, May, 1988), http://cgi.gjhost.com/~cgi/mt/netweaverarchive/000236.html (accessed July 6, 2010).

– eventually made it possible to link the online personae of callers back to their physical person, throughout the 1980s and early 1990s it was impossible to know who users were outside of either voluntary disclosure on their part, secondary validation in the form of call-back verification programs, or an active investigation by law enforcement. This meant that users could represent themselves as whatever they chose to, often from behind a pithy handle that was the outward emanation of their identity and the means by which they were known on other systems within an area code. Stripped of the typical physical indicia of affiliation, social status, race and the like, users were judged solely on the basis of the messages they left on the system, the files they uploaded, and their status in the various online games ("doorgames") that quickly became a BBS staple. For many, with not a few awkward computer geeks amongst them, BBSes represented social salvation: they were a forum in which users were freed from day-to-day social superficialities and judged on the basis of intellect or persona alone.[106] They could speak of matters that they might ordinarily be reluctant to address from behind a virtually untraceable alias and build a reputation independent from who they were "IRL" – in real life.

A defining feature that differentiates BBSes from the types of computer-centric communities that preceded and succeeded them is the degree to which they were bounded by geography, albeit geography filtered through the economic constraint of the telephone company area code. As demonstrated previously, prior to the microprocessor revolution user communities existed purely in physical space; the capital requirements of mainframe

[106] Sabby, "I Miss BBSs," in *Everything2* (East Lansing, MI: Everything2.com, March 22, 2001), http://everything2.com/title/I+miss+BBSs (accessed September 10, 2009); John Rappold, "Sometimes I Miss the Old BBS Days," in *Travelling Down the Information Backroad* (blog), January 23, 2008, http://johnrappold.org/blog/?p=395 (accessed June 4, 2010); Rob O'Hara, *Commodork: Sordid Tales from a BBS Junkie* (Self-published: Lulu.com, 2006), http://books.google.ca/books?id=5RV9iiDalQoC&lpg=PP1 (accessed June 4, 2010).

computers meant that they were owned only by universities and big businesses, so one had to gain entry to a traditional, physical community in order to use the machines. Internet-era online communities possess no geographic boundaries whatsoever beyond how far a fibre-optic cable can be pulled or a microwave transmitted, a fact that has proven to be a pernicious problem for legislators, authoritarian governments and copyright holders. The BBS was the middle ground between the old world of the purely physical and the new world of the network, enabling anonymous electronic interaction but geographically constraining it through area codes and the cost of long-distance calls.

This combination of anonymity through the dissociation of the terminal and identity-creation through the use of aliases within an identifiable, local context had no real precedent in the mainframe computer era and is only partially replicated in current, location-centric online forums like Craigslist. It is not strictly accurate, however, to characterize BBSes as purely local. After 1984, when Tom Jennings linked together a number of Bay Area BBSes that used his Fido software into FidoNet, messages and files could be syndicated via dial-up to other subscribing systems.[107] Using a hierarchical numbering system that split top-level zones into regions, networks and individual BBS nodes, users could participate in public forums that were distributed nationwide via what was called Echomail and send private, user-to-user emails via Netmail.[108] Messages were not sent in real time, but were instead compressed into bundles exchanged between systems outside of prime rate calling hours. While FidoNet and its companion protocol suite faced some competition from other means of networking BBSes, like the QWKmail

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[107] Randy Bush, *FidoNet: Technology, Use, Tools and History* (Homewood, IL: FidoNet Technical Standards Committee, 1993), http://www.fidonet.org/inet92_Randy_Bush.txt (accessed March 30, 2009).
[108] FidoNet Technical Standards Committee, *FTS-001: A Basic FidoNet Technical Standard, Revision 16* (Homewood, IL: FidoNet Technical Standards Committee, September 30, 1995), http://www.ftsc.org/docs/fts-0001.016 (accessed March 30, 2009).

standard used by systems that ran the WWIV BBS software, Fidonet Technology Networks (FTNs) remained the dominant standard for message sharing until the Internet displaced the BBS in its entirety.[109] FidoNet counted some 35,000 systems in its nodelist at the peak of its popularity in 1995.[110] Regardless of the existence of long-distance BBS networks, though, access to entities like FidoNet and the numerous smaller, independent networks that used its technology always proceeded through dialling in to a local system.

Anonymity is often a mask for illegal or *sub rosa* behaviour, and BBSes were not exempt from this; in fact, many systems existed purely for the purpose of facilitating criminal activity, be it in the form of trading commercial software, disseminating stolen calling card information (the better to escape long distance charges with) or exchanging tips on how to hack computer systems. The weakening of the physical and institutional constraints that had formerly governed communities of computer users meant not only that less social surveillance and control over user activities took place, but also that the diversity of reasons for which these communities came to exist increased. This tendency was compounded not only by the redefinition of computer technology as a commodity instead of a class of privileged goods, a fact that increased the total number of computer users and thus the potential for bad behaviour, but also the anonymity that BBSes offered. A disparate, shadowy group of bulletin board systems dedicated to illegal or quasi-legal activities comprised the digital underground, with software piracy acting as a driver of other forms of criminality. As the BBS art form known as ANSI achieved its fullest

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[109] Patrick Y. Lee, *QWK Mail Packet File Layout, Version 1.3* (Location Unknown: July 6, 1992), http://www.textfiles.com/programming/qwk.txt (accessed March 30, 2009). Note that Lee indicates that the QWK format originated with Clark Development Corporation's PCBoard BBS software. The format was adapted by WWIV as a means of providing network mail.

[110] FidoNet Network 282 Group, *The FidoNet Nodelist: A Historical Analysis* (Minneapolis, MN: February 2, 2005), http://www.rxn.com/~net282/nodelist/ (accessed March 30, 2009).

expression on this last class of systems, we must now turn to the history of software piracy to complete the picture of the operating environment of the period.

Software Distribution and Software Piracy

When the first microcomputers were released for sale to the public, there was no established personal computer software industry.[111] During the initial phases of the transformation of computers from elite to commoditized goods, when both manufacturers and the market consisted mainly of technologically adept hobbyists, computers were owned purely for the problem-solving pleasure of assembling and then programming them. Indeed, the process of establishing a market for commercial software was beset with both technological and economic difficulties. The ecology of the microcomputer market was so diverse and was evolving so rapidly as to make devising a standard format for information interchange difficult, and no one platform had attracted users in quantities sufficient to justify attempting to develop and market commercial software as it is now known. A critical mass of users gathered around a platform defined by fixed standards was a condition precedent of the emergence of a software industry, but platform adoption was most frequently driven by the development of killer applications – a catch-22.

Until then, "software distribution" consisted of the exchange of program source code between attendees at hobbyist meetings or through publications like *Byte* or *Dr. Dobb's Journal.*[112] The centrality of programming to the market purpose of early

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[111] Histories of the software industry are, in my experience, few and far between. A good treatment is found in Martin Campbell-Kelly, *From Airline Reservations to Sonic the Hedgehog: A History of the Software Industry* (Cambridge, MA: MIT Press, 2003).

[112] Michael Swayne, "Dr. Dobb's Journal @ 30," in *Dr. Dobb's Journal,* January 1, 2006, http://www.drdobbs.com/architecture-and-design/184406378 (accessed June 14, 2010); Tom Halfhill, "Tom's Unofficial *Byte* FAQ: The Death of *Byte* Magazine," in *Halfhill.com* (Burlingame, CA: Halfhill.com, April 18, 2007), http://www.halfhill.com/bytefaq.html (accessed June 14, 2010).

microcomputers is underscored by the fact that early microcomputer adopters were obsessed with creating software compilers and that early mass-market microcomputers sold by Apple, IBM, Commodore and Tandy all shipped with built-in BASIC interpreters.[113] As an uncomplicated, widely-understood programming language that could work within the limitations of early consumer-grade microprocessors, BASIC matched the constraints of the early industry well. This did not go unnoticed by Bill Gates and Paul Allen, who got their professional programming start in 1975 by writing a basic interpreter for the Altair 8800.[114] Shortly thereafter, Gates ignited what was probably the world's first software piracy controversy when he accused members of the Homebrew Computer Club of theft for sharing copies of it amongst themselves.[115] Programming was not merely *a* function of the early microcomputer; it was *the* function. What else were computers for?

As described earlier in this chapter, the market for personal computer hardware did not properly emerge until it had shaken off those hobbyist trappings that represented technological barriers to mass adoption. Consumers needed computers that were packaged as discrete, complete systems rather than kits that required end-user assembly

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[113] Michael Steil, "1200 Baud Archaeology: Reconstructing Apple I Basic From a Cassette Tape," in *Pagetable.com* (blog), July 22, 2008, http://www.pagetable.com/?p=32 (accessed June 14, 2010); *Comp.sys.apple2.programmer Frequently Asked Questions* rev. 130.0615.1634 (Location Unknown: June, 2010), http://home.swbell.net/rubywand/csa2pfaq.html (accessed June 14, 2010); International Business Machines, "The IBM PC's Debut – Product Fact Sheet," in *IBM Archives* (Aramonk, NY: n.d.), http://www-03.ibm.com/ibm/history/exhibits/pc25/pc25_fact.html (accessed June 14, 2010); Ian Matthews, "The Amazing Commodore PET," in *Commodore.ca* (Chestermere, Alberta: Up & Running Technologies Incorporated, February 22, 2003), http://www.commodore.ca/products/pet/commodore_pet.htm (accessed June 14, 2010); Oldcomputers.net, "Radio Shack TRS-80 (Model I)," in *Oldcomputers.net* (Orange County, CA: Oldcomputers.net, n.d.). http://oldcomputers.net/trs80i.html (accessed June 14, 2010).

[114] Wallace treats this in *Hard Drive,* cited above. See also Michael Holley, "Altair BASIC for the 6800," in *Southwest Technical Products Corporation* (Scottsdale, AZ: Southwest Technical Products Corporation, 2006), http://www.swtpc.com/mholley/Altair/Altair_Basic.htm (accessed June 14, 2010).

[115] Bill Gates, "An Open Letter to Hobbyists," in *Homebrew Computer Club Newsletter 2*, iss. 1 (February 3, 1976), http://www.digibarn.com/collections/newsletters/homebrew/V2_01/gatesletter.html (accessed June 14, 2010).

or tinkering. Once this took place, and here the example of VisiCalc stands as a useful marker of the beginning of the period, demand for software worked synergistically with demand for computers to encourage the adoption of both.[116] Software drove sales of computers, and increases in the size of the user base of a platform drove software development. Floppy disks became standardized on an industry-wide (physical dimensions) and per-platform (formatting/encoding) basis, a development that permitted the mass distribution of software as retail goods. More significant, however, was the fact that computers came to be regarded as tools rather than the speciality playthings of experts or aficionados.

What distinguishes software from other species of goods is that precise duplicates of it can be created in seconds by end users who possess no great technical acumen or expertise, that these duplicates can be transmitted automatically over long distances, and that the copying process does not produce degradation in either the source or the original. With other physical goods bought from their content, like records or books, duplication was either time- or capital-prohibitive, and each duplicate consumed physical resources. As the cost of the storage or transmission of software copies was typically orders of magnitude less than the price commanded by legitimate copies in the marketplace and these copies were 100% functionally equivalent to genuine goods, widespread access to copying technology in the form of the microcomputer made piracy all but inevitable.[117] In other words, the market forces that encouraged the development of computers and the software industry, namely commoditization, mass marketing and the use of computers as

[116] IBM made sure that a PC port of VisiCalc was available by the time it began shipping units to customers. The screenshot featured earlier is actually from the DOS version.

[117] The introduction of the cassette tape produced the same phenomenon within the record industry with one key difference: a tape-dubbing machine could only produce copies, while personal computers permitted their users to both create *and* copy software.

general-purpose calculating machines, were responsible for the emergence of the mirror-world of illegal software trading.

The market was not all, however. The centrality of programming within the microcomputer paradigm and the degree of plasticity afforded by software made computers dynamic, generative consumer devices rather than fixed, receptive products.[118] Compare, as an example the differences between a book, a television set and a personal computer. The first is a fixed receptacle of externally-generated static information; the second is a fixed receptacle for the display of externally-generated dynamic information disseminated through broadcast, essentially a receive-only terminal. Even in the pre-Internet era, a microcomputer was always a mutable network node capable of both receiving and displaying externally-generated content as well as creating and disseminating content of its own.[119] For books or televisions, the equivalent would be if a printing press were included with every copy of Tacitus, or if a studio and broadcasting tower were included with the sale of every screen.

This broke the microcomputer software market – and eventually the market for all computer software – into three segments: purely commercial applications developed and sold by established businesses; try-before-you-buy "shareware" software created by small software shops and distributed via disks in Ziploc bags, compilation CD-ROM volumes, or BBSes; and unrestricted "freeware" that hewed to the original spirit of the hobbyist movement. This last category encompasses the antecedents to the modern open source movement epitomized by the Free Software Foundation, though in the microcomputer era

[118] Eric S. Raymond, *The Cathedral and the Bazaar: Musings on Linux and Open Source from an Accidental Revolutionary* (Sebastopol, CA: O'Reilly, 1999).
[119] In this context, the meaning of "network node" must be expanded to include the "sneakernet," referenced earlier, if the term is to apply.

Old school: 5¼" floppy disk, double sided, high density. Total capacity: up to 1.2 megabytes depending on formatting.. Earlier disks had a total capacity of 180 or 360 kilobytes – or possibly even less. The adoption of a standard size and format for removable storage led to both the consumer software industry and widespread piracy. [122]

binary distribution was more common than the transfer of source code.[120] As has been increasingly obvious to the consuming public since the mid-1990s, the widespread adoption of computing technology and the piracy it encouraged has been of game-changing significance to the business models of traditional content distributors, but that subject lies beyond the scope of the exercise undertaken here.

Before the BBS, software distribution and software piracy occurred solely in the physical world through expedients like the sneakernet – the physical transportation of data between computers by users.[121] Physical transportation mechanisms are still in use today for the transfer of very large data sets, typically in the tens of terabytes, as while the latency of this method is very high, so too is its throughput: it is often faster to send a large-capacity hard drive through the mail than it is to transfer the data contained on it through a network. Once the BBS arrived, however, the bulk of the world's shareware and freeware software was disseminated through the telephone network via the dial-in systems connected to it. Commercial software continued to be distributed in retail boxes until the early 2000s, when

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[120] Christopher M. Kelty, *Two Bits: The Cultural Significance of Free Software* (Durham: Durham University Press, 2008).

[121] *FOLDOC, The Free On-Line Dictionary of Computing,* s.v. "Sneakernet," accessed June 2, 2010, http://foldoc.org/sneakernet.

[122] Qrren, "Maxell MD2-256HD, 5.25-inch Floppy Disk," in *WikiMedia Commons* (San Francisco, CA: Wikimedia, April 10, 2006), http://commons.wikimedia.org/wiki/File:5.25-inch_floppy_disk.jpg (accessed June 2, 2010).

convergence between high-speed consumer network access and electronic transaction processing made digital distribution feasible, but between 1980 and the turn of the century the BBS was king. Shareware was amenable to BBS-based distribution as it separated the transport of software and payment according to the method that was most secure and efficient for each function. Distribution of trial versions of software took place informally, with systems receiving copies uploaded by users or transferred through FidoNet-style "filebone" networks.[123] Registration codes or keys needed to unlock the full functionality of the software or eliminate irritating reminder messages ("nagware") were delivered via postal or electronic mail upon receipt of physical payment.

Every software developer that made money in the industry depended on the market-making popularity of the personal computer while fearing the erosion of profits through the distribution of perfect copies. For software titans like IBM, WordPerfect, Ashton-Tate (makers of the once-popular dBase database software) and Lotus, the threat of end-user piracy was never felt as keenly as it was for those who developed software for the home market, like games.[124] Large, established businesses feared the threat of legal liability associated with the use of unlicensed commercial software and held assets that could be seized to meet an award of damages. Besides, as classic physically-bounded communities, businesses were capable of subjecting users of computing resources to physical and electronic surveillance. They thus enforced normative standards of good behaviour, like not stealing intellectual property. In the chaotic environment of the home PC market, stronger protection measures were needed to clamp

[123] Janet Kracht, "A Brief History of FidoNet File Distribution," in *FidoNews* (Mortsel, Belgium: Fidonet.org, n.d.), http://www.z1.fidonet.org/filehist.htm#fdhist (accessed June 2, 2010).
[124] Despite this, the Business Software Alliance, an industry group dedicated to the eradication of piracy in the corporate sphere, was formed in 1987: see http://www.bsa.org.

down on illegal copying. These took the form of increasingly elaborate copy-protection schemes, from the use of "key disk" routines that required the presence of the original media before the program wound run, keyword schemes that forced users to type in a word or phrase from the software's manual before proceeding deeper into the program, and eventually hardware dongles that attached to a spare port on the system and validated ownership through cryptographic challenge-response.[125]

ASCII art at its finest: FILE_ID.DIZ release descriptor for "Syndicate," a game published by Bullfrog Productions in 1993 and released by warez group Razor 1911 not long afterwards. Razor began in Norway in 1985 as a Commodore 64 cracking group. The address for their demo division, which specializes in creating "loaders," advertising programs prepended to releases of pirated software, is available at http://www.razor1911.com.[126]

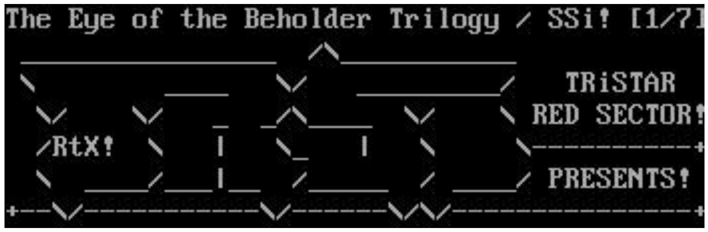
As an anonymous, electronic community hidden within the telephone network, the BBS was an ideal enabler of the trading of pirated software – and any other illegal activity that might be better concealed behind the mask of the terminal. Fear of civil or criminal sanction led to the development of a bifurcation between those systems that offered only shareware or freeware applications and the network of *sub rosa* systems that specialized in pirated software. BBSes that formed part of the first set, known as "public domain" or "PD" boards, were typically publicly accessible, advertised systems whose operators demanded some real or verifiable information from their users during the account signup process and operated strictly within the letter of the law. The second,

[125] DT, *Copy Protection: A History and Outlook*, (Location Unknown: n.d.), http://www.textfiles.com/100/copyprot.pro (accessed June 12, 2010).
[126] Razor eventually attracted the attention of the U.S. Department of Justice: Paul J. McNulty, *Former Leader of Razor 1911, the Oldest Game Software Piracy Ring on the Internet, Sentenced* (Alexandria, V.A.: U.S. Department of Justice, United States Attorney's Office, Eastern District of Virginia, June 6, 2003), http://www.cybercrime.gov/pitmanSent.htm (accessed June 12, 2010). Razor 1911, *Syndicate FILE_ID.DIZ Artwork*, (Location Unknown: Razor 1911, June 17, 1993), http://thepiratebay.org/torrent/4147426/SYNDICATE-RAZOR (accessed March 3, 2009).

much smaller set consisted of "warez" (from "soft*wares*") boards. These were private, handles-only systems that were advertised by word of mouth and used mechanisms like password-protected new user signup procedures and upload ratios to vet the quality of new members and maintain the flow of the sought good that was pirated software. While there was always some overlap between these two classes of systems, the maturation of the personal computer software industry, attention from law enforcement and the ever-increasing size of software increased the cleavage between them by encouraging specialization within both the PD and warez worlds.

No copy protection scheme has ever proven invulnerable to dedicated attempts to defeat it, a fact that has remained true ever since the first efforts by software houses to clamp down on unauthorized copying. The same development and debugging tool-chains that make it possible to create software on microcomputers made it equally possible to defeat copy-protection schemes through the disassembly of compiled software. The tools, however, mean nothing without the willingness to use them; in this, microcomputer pirates adapted the hacker counterculture of innovation and resistance to externally-imposed limits to the intellectual challenge of breaking copy protection. Crackers, always anonymous and forgotten with the rise of each successive platform, warez group, or spate of software releases, took it upon themselves to circumvent the routines publishers used to attempt to protect their product. They enjoyed the exercise of technical expertise and discipline this demanded, but they also sought the enhancement of personal status devising a successful crack conferred, for new warez was the currency of the underground.

As the BBS and warez scenes matured, the lone cracker – perhaps best epitomized by “Apple Bandit,” whose moniker appears in dozens of cracked releases for the Apple II – was replaced by the warez group. The increased size and complexity of software, including the sophistication of copy-protection routines, pressured warez groups into organizing their personnel into functional units that divided the labour required to produce pirated copies. An ever-shifting roster of individuals dedicated to supplying new releases, breaking their copy-protection routines, splitting them into easily-downloaded chunks, couriering the releases to long-distance sites and acquiring the fake calling cards and toll codes that supported the couriers gradually came to define the membership of any mature warez group. Such organizational stratification was the mirror image of equivalent developments within established companies in the software and personal computer industries: as the market developed, the solo innovator was replaced by the corporation.



FILE_ID.DIZ ASCII art for the Eye of the Beholder Trilogy, a series of 3D role-playing games released by Strategic Simulations Incorporated in 1995. This release was packaged by TRiSTAR (the above logo says “TRIST” in ASCII). FILE_ID.DIZ files were included in archives uploaded to BBSes as they provided an automatic file description, thus obviating the need for the uploading user to describe the transferred file. As demonstrated by this and the preceding example, they also served as a vehicle to advertise and brand the warez group that put a release together.[127]

A curious aspect of the pirate scene that persists to this day is that while members of a warez group might flout copyright laws, commit any number of subsidiary criminal offences (mainly fraud) in furtherance of their goals and organize themselves in much the same way as any other gang devoted to a criminal enterprise, group members only rarely profited from their illegal acts. As the current ubiquity of BitTorrent-based piracy of applications, games, movies, music and all other forms of digital media demonstrates, it

[127] TRiSTAR, *Eye of the Beholder Trilogy FILE_ID.DIZ*, (Location Unknown: TRiSTAR, 1995).

appears that little real money is made through most of the illegal distribution of copyrighted content. Instead, the motive force that animates the top players in the warez scene, both during the era of the BBS and the Internet, is the acquisition of “eliteness” – the reputation carried by those within the community who have access to the newest releases, the fastest connections, and the most secretive and exclusive distribution sites. To stake it all, including the stigma of a criminal conviction, for the sake of cultivating an online reputation entirely divorced from the physical self and community to which one belongs would be incomprehensible but for the fact that such occurrences have become commonplace in the information society knitted together by the Internet. When the BBS and warez scenes first emerged in the 1980s, however, these were truly novel phenomena – virtual, secret societies whose members, when masked as their online alter egos, recognized no cultural norms beyond those their subculture, enforced these through constraints embedded in software, and dedicated themselves to the pursuit of excellence as they defined it.[128]

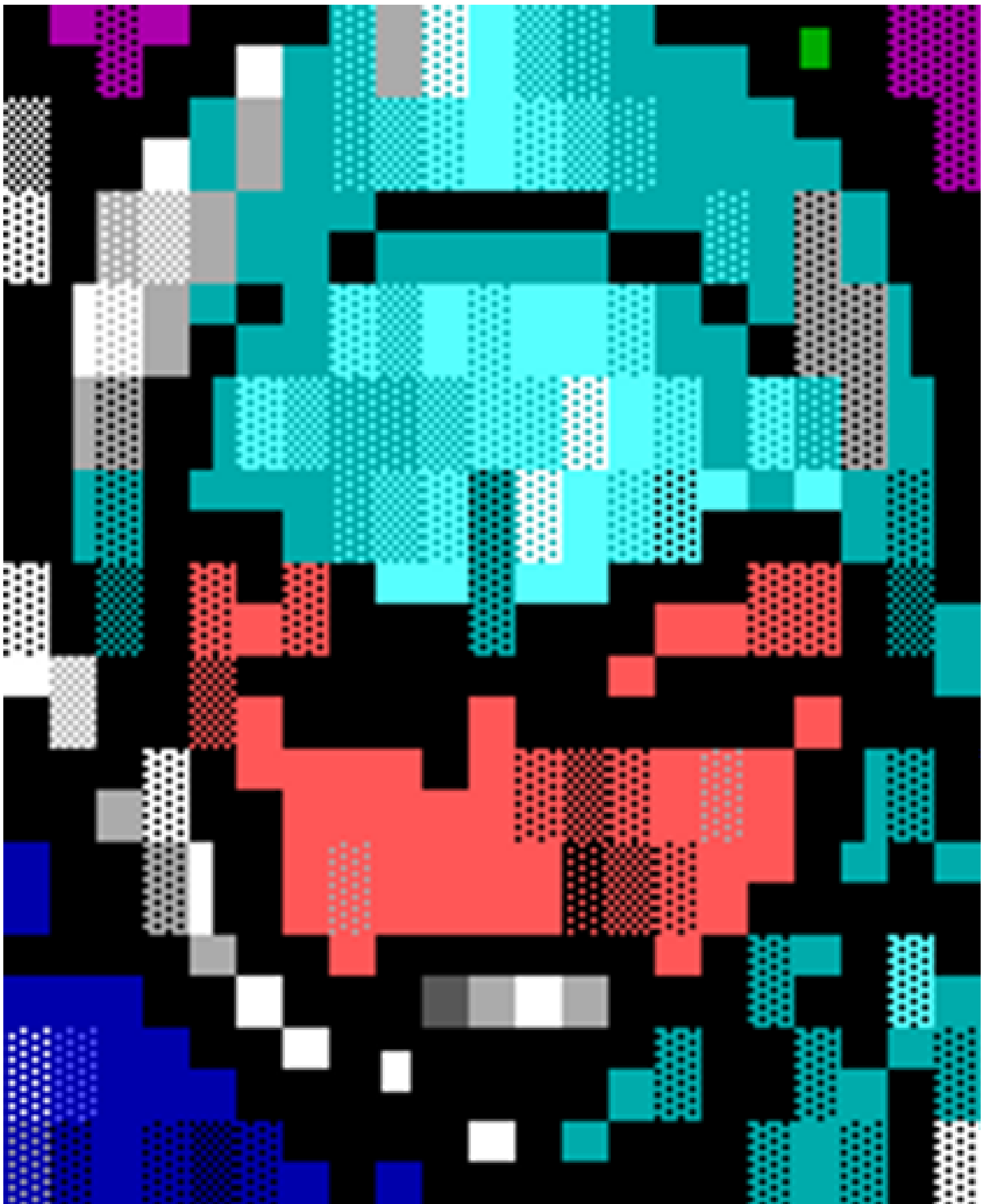
Earlier, the visual aesthetic of bulletin boards was described as “the form of the system,” the combination of trope, image and software constraint that defined this type of online interaction. All BBSes presented a variation of this form to their users through their interface, but it was under the evolutionary pressures of the pirate scene that the quality of ANSI artwork reached its apex. Pirate BBS operators sought such artwork to give their systems the “elite” look and feel that was one of the markers of status within this community. ANSI artists produced many of the works that they did to enhance their own reputation within the “scene” and gain access to elite systems and the sought goods

[128] The “warez ethic” is in many respects a permutation of the “hacker ethic”: See Gabriella Coleman, “Code is Speech: Legal Tinkering, Expertise and Protest Amongst Free and Open Source Software Developers,” in *Cultural Anthropology* 24, no. 3 (2009): 420-454.

they offered. But while this illustrates why ANSI artists chose to draw in the first place, it does not explain why these artworks look the way they do. For that, we must turn to an exposition of the technological constraints imposed on these artists by their computing platform of choice, the IBM PC. The relationship between it and the telephone-based networking paradigm of the era explains the origins of the form, the upper limits of what might be expressed through it, the duration of its dominance, and its ultimate decline.

III

Mosaic in Text-Mode Miniature: Technological Constraint and the Development of Form



Detail from "Huma" by Lord Jazz of Ansi Creators In Demand (ACiD), October, 1994.[129]

[129] Lord Jazz, "Huma," in *ACiD: The Acquisition, October, 1994* (Location Unknown: ACiD Productions,

"The Evil Palace BBS logo" by Chips Ahoy of Aces of ANSI Art, the precursor to ACiD Productions. Date unknown; probably 1990 or 1991.[130]

Take a moment to examine the imaged depicted above. As indicated by the artist's signature in the lower right corner, it was drawn by "Chips Ahoy" of Aces of ANSI Art. The date of its production is unknown, though it likely hails from 1990 or 1991. Note the simplicity of both the logo font, which features only the most rudimentary shading, and the flat perspective used to depict the "evil palace" that presumably represents the BBS this artwork was intended to advertise. The colours are garish, the level of detail is low – the slightly bizarre blue-and-brown doughnut surrounding the towers is supposed to be a moat – and there is lots of blank, unused space in the composition.[131] All of the hallmarks of BBS artworks advertising a pirate system are there, however, from the reference to the speed of the system's modem (a "USR Dual

October, 1994), http://www.textfiles.com/artscene/acid/ARTPACKS/1994/acdu1094.zip (accessed June 2, 2010).

[130] Chips Ahoy. "Evil Palace BBS Logo," in *Aces of ANSI Art – Remembrance Pack* (Location Unknown: n.d.), http://www.acid.org/ftp/aaa-8991.zip (accessed May 30, 2010).

[131] The smiley-face symbols on the flags are also somewhat incongruous with the type of standard one might expect to see fluttering above an evil palace.

Standard" was a 16,800 baud modem manufactured by US Robotics), the slightly adolescent handles of its systems operators and his co-operators, and the fact that it was U.S. headquarters of "PE," presumably a warez distribution group. This system was located in the 408 area code, which covers Santa Clara County and Cupertino, California.

"Nicotine BBS Logo," drawn by Sensei for the 50th ACiD Acquisition artpack, November, 1996. This is one of the last pieces of ANSI BBS artwork produced by ACiD before their switch to the production of ASCII and bitmapped images, which were forms more compatible with the burgeoning Internet.[132]

Now consider the "Evil Palace BBS logo" in light of the above, which was drawn scarcely six years later and is an example of the form at its high-water mark. While the colours are still garish, this logo features both shading within the font itself, which is substantially more complex and stylized, as well as background shading that flows from low- to high-intensity blue and back again. Accents on the points of the letters are present, notably the cross-shaped cyan star on the "N" and the gray double mid-dots (·) above the "I." The text of the logo is spelled out beneath it, a convention that became necessary as logos increased in complexity (and thus illegibility), and the camouflaged artist's signature blends into the background at the lower right. As this was a logo for use

[132] Sensei, "Nicotine BBS Logo," in *ACiD: The Acquisition #50, November, 1996* (Location Unknown: November, 1996), http://www.textfiles.com/artscene/acid/ARTPACKS/1996/acid-50a.zip (accessed March 27, 2010).

within a bulletin board rather than an advertisement for the system, no phone number or other bragging-rights information about the speed of the system, its storage capacity or its group affiliations is present. While both artworks have been converted into high-resolution images that can be embedded in this document, in their original form both were decidedly low-resolution pieces. “Evil Palace” was drawn in the then-standard text-mode screen resolution of 80 by 25 characters, while “Nicotine” is even smaller at 80 by 17 characters.

As historical documents, these two artworks give rise to certain obvious questions. First, why do these works appear in the form that they do, drawn as they are with a limited brush-set of sprites and available foreground and background colours, and why is their resolution so low? How would these works have been viewed by the user of a bulletin board system at the time they were created? What accounts for the evolution in drawing styles in such a short period, and why was this form of digital art bypassed and superseded by others? How is it possible that these artworks are still available for viewing and analysis given that the technological substrate that spawned them has been obsolete for approximately fifteen years, no official archivist has ever organized or curated them into a collection, and they are volatile, easily-deleted digital documents? Finally, beyond the seemingly innate human desire to create art using whatever means are available, a tendency that undergirds everything from cave paintings to the Damien Hirst’s infamous “Shark,” why were they created in the first place?

These questions can only be answered by exposing the technological and social constraints that prescribed the limits of the form and the reasons why individual artists, nearly all anonymous and unknown to posterity, chose to express themselves within it.

As shall be demonstrated in this and the subsequent chapter, the latter focusing on the ethos of the underground art scene, these works appear as they do because of the microcomputer platform on which they were created, the rules governing human-machine interaction in the era in which they were prevalent, and the economic or market conditions that determined both the capabilities of the IBM PC computer platform and the ecology of systems known as bulletin boards.

The IBM PC and Periodization

Much of the history presented in the preceding chapters has focused on the evolution of the personal computer market during the 1980s, with attention paid to both the paradigm shift represented by the advent of the microprocessor and the role of hobbyist development in the creation of the industry. This treatment was necessary not only to illustrate changing market conditions during that seminal decade, but also to explain why the commoditization of computers led to the breakdown of normative structures surrounding their use and how this encouraged the development of the kind of virtual, private, *sub rosa* communities epitomized by pirate bulletin board systems. In this it was noted that while the early 1980s saw manufacturers like Commodore and Apple gain limited traction in the marketplace, by the end of the decade they had been displaced by the wide range of companies who adopted the systems architecture originally advanced by industry latecomer IBM in the form of the IBM PC.

For most of the 1980s, IBM's design was significantly more expensive than the offerings of Commodore and Apple, its two principal competitors. Three factors explain why its platform came to outsell all others. First, IBM initially targeted its traditional clientele in the corporate market, where customers were willing to pay a price premium for the stability of the IBM brand. Adoption of the IBM PC in the home market was driven either by corporate users' desire for compatibility between home and work computers or, later, price cuts occasioned by widespread cloning of IBM's design. Second, both Apple and Commodore's systems used custom chipsets and mainboards, typically changing processor families between platform generations in a way that broke true backwards compatibility. By selling a discrete, self-contained "package" rather than a system that conformed to a broad standard, these manufacturers made themselves responsible not merely for designing and marketing systems, but also for guaranteeing operating system and application software support. Finally, cloning of the IBM PC design led to platform inertia: all manufacturers, including IBM, had to conform to the system standard lest they fragment the market that sustained them. This ensured basic compatibility across generations of processors and advances in display, storage and other technologies.

All of the ANSI artworks that will appear in these pages were created between 1990 and the turn of the century. No earlier or later examples will be employed; indeed, few earlier examples exist. This is because this class of artwork is uniquely referable to the platform- and market-specific technological constraints that defined the operating environment of this branch of the personal computer market during this period. These were the dominance of the IBM PC platform, the evolution of technological capabilities within it that encouraged this type of expression, and the broad limits prescribed by the type and quality of network access available to the majority of computer users. Here it is important to point out that BBSes ran on all computing platforms, not just IBM PC-compatibles, and that during the 1980s some of the most vibrant examples of BBS culture and digital artwork were created on Commodore or Apple computers. Because of the design choices of their manufacturers, however, these platforms carried with them vastly different technological strengths, variations in capability that strongly influenced the types and modes of expression that would become prevalent on each platform. Exposing these differences in capability stands at the center of the explanation of why ANSI artwork developed when and in the way that it did.

To illustrate the point, consider the case of the Commodore 64 (C64). As a computing platform, its raw processing capabilities were significantly worse than those of the IBM PC, but as a *gaming* platform they were much better: it had dedicated, high-resolution graphics capability delivered by the MOS VIC-II graphics processor (320x200, 16 colours) and could produce decent-quality synthesized sound through its included MOS SID-6581 audio co-processor. Equivalent features were not featured in IBM PC-compatible systems with any consistency until at least 1992, and even then were provided by third-party hardware installed by the user. As was the case later with the IBM PC, the

Commodore 64 “cracktro” loader for “Black Lamp,” a platform game released by Software Creations in 1988. As the intro indicates, Ham of the warez group Fairlight cracked the game’s copy-protection on February 26, 1988, and Fairlight member Woodo wrote the high-resolution, scrolling intro screen that gives credit to the group. A still image does not do justice to the loader, which featured animated graphics and an accompanying music score.[133]

[133] Woodo, “Black Lamp Cracktro Loader,” in *Black Lamp* (Fairlight Release), (Location Unknown: Fairlight, February 26, 1988), http://www.thegamearchives.com/files/b/black_lamp_firebird_+_fairlight-c64-various.zip (accessed March 29, 2010).

C64 developed a vibrant BBS and software piracy community dominated by warez groups, but the development of computer art on this platform took advantage of its enhanced graphics and sound through the production of “intros” or “cracktros” (the latter were added to the beginning of warez releases to give credit to the releasing group) that were colourful, animated, soundtrack-scored examples of programming prowess. C64 BBSes never developed true BBS artwork like that of the IBM PC because other, better opportunities for expression existed on the platform and because the text mode of the same was both low resolution (40 x 25 characters) and did not natively support the changing of background colour attributes. Furthermore, the limited amount of random-access memory available on the C64 (64 kilobytes) ceded the development of complex BBS software to more capable platforms, and while some block-drawing characters were available in the form of C64-proprietary PETSCII (a derivative of the standard ASCII character set), the speed of modems available during its heyday made the extensive use of text-mode BBS graphics painfully slow.

What this means, then, is that while microcomputers presented their users with an unparalleled degree of creative potential through the plasticity of software and the promise of programming, the capabilities of a given platform placed limits on what could be done with it. Artistic expression using microcomputers thus pitted human ingenuity against the restrictions defined by hardware and operating systems. Above this lay the larger economic constraints that determined the availability and affordability of specific microcomputer platforms, with factors like cost and the degree of consumer adoption of a given system influencing the prevalence of specific art forms by placing limits on the size of the pool of users that might become either artists or art aficionados. These conditions were further influenced by the availability of consumer-grade networking technologies and the amount of data that could reasonably be transported over the wire, for without the ability to easily distribute and share art, no audience for the works could exist. Digital expression was thus a matter of matching means to ends, with technological constraint determining the limits of the possible as well as the sought social and other goods that might accrue to talented artists on the basis of their reputation and what they might trade in exchange for the fruits of their creativity.

The Scale of the System

A discussion of the technological constraints that defined the IBM PC during the period under study and a layperson's explanation of the terminology used to describe these specifications is necessary if the full breadth – or lack thereof – of what this family of systems were capable of is to be meaningfully understood. The assumptions of the computing present, regardless of the fact that current platforms use substantially the same underlying technology in use during the 1980s and 1990s, must be cast off or significantly scaled back: in 1990, only the barest analogues to current high-speed, graphics-intensive, multimedia-capable and network-aware systems existed. To demonstrate the outlines of the platform as well as the exponential evolution in capacity which it underwent between its appearance in 1980 and the decline of the form in the late 1990s, the following table has been assembled:

PC-Compatible Platform Capability, 1980-1996[134]

Specification	Period I (1981-6)	Period II (1986-90)	Period III (1990-1996)
CPU (family / clock speed / MIPS estimate)	Intel 8086/88 series 4.77 Mhz / ~0.33 MIPS	Intel 80286 series 6, 8 or 12.5 Mhz / ~0.9 to 2.6 MIPS	Intel 80386/486/586 Series 16, 25, 33, 66, 90, 133, 166 or 200 Mhz / ~5 to 541 MIPS
Random-Access Memory (RAM) Complement	16 – 256kb (640kb with full expansion)	384kb – 1mb	640kb to 64mb (4mb – 16/32mb standard on 80386/486/586 systems)
Graphics	Monochrome or Color Graphics Adapter (CGA); 80x25 16-color text mode, maximum 640x200 4-color graphics mode	Monochrome or CGA/Enhanced Graphics Adapter (EGA); 80x25 or 80x50 16-color text mode, 320x200 or 640x200, 16-color graphics mode from 64-colour palette	Video Graphics Array (VGA) or Super Video Graphics Array (SVGA); 80x25 or 80x50 16-color text mode, 640x480 or spec. maximum 800x600 256-color graphics mode
Storage (media/density)	360kb double-density 5¼" floppy disk drive	360kb or 720kb double-density 3½" floppy disk drive, later 1.44mb high-density 3½" or 1.2mb 5¼" floppy disk drives; hard drives between 5 and 40mb	All floppy drives identified earlier, but 3½" standard; 40mb - ~1GB hard drives; CD-ROM (640mb optical media)
Modem Speed	300 baud (bits/sec) – 1200 baud, acoustic coupled. Equivalent to between 37 and 150 *characters* per second	1200 or 2400 baud (1989), direct connection to phone line (max 300 characters per second)	2400, 9600, 14400, 28800 or 33000 baud (56k technology was asynchronous and only applied to Internet Service Providers); some Integrated Systems Digital Network (ISDN) modems at 64k. 28.8k standard by 1995-6; ~3.5 kilobytes/second theoretical maximum.

[134] As the IBM PC defines a technical specification that gave rise to a platform instead of consisting of a family of systems that were released over time by a single manufacturer, the task of attempting to determine average system specifications during a given period is significantly more difficult than reconstructing, say, the gradual increase in capability seen between the Apple I, Apple II, Apple Macintosh and subsequent systems. As we proceed through describing the subsystem technologies that were responsible for overall improvements in the capabilities of the platform, references to technical specifications will be provided.

Processor cycles are synchronized by clock crystals that oscillate at a given rate per second. Even in the simplest of cases, a processor will not complete one complete instruction per clock cycle and different processor families require different numbers of operations to process an instruction.[135] This makes clock speed a valid comparator of processor performance only within the same processor generation and family, with MIPS (millions of instructions per second) standing as the preferred, semi-stable measure of cross-family processor performance.[136] The 1981 IBM PC used an Intel 8086 processor clocked at 4.77 megahertz (millions of cycles per second) and roughly 0.33 MIPS; the second-generation 80286 from the mid- to late-1980s ran at a maximum of 12.5 Mhz and 2.6 MIPS; the third, fourth and fifth-generation 80386, 80486 and 80586 ("Pentium") series of systems had clock speeds of between 16 and 200 Mhz and MIPS measures between 5 (80386SX, 16 Mhz) and 541 (80586 "Pentium Pro," 200 Mhz).[137] In 2010, CPUs are routinely clocked at two *gigahertz* or above, contain multiple processor cores, and are rated at tens of thousands of MIPS.[138] By contemporary standards, the processing power of IBM-compatible PCs during the early- to mid-1990s was miniscule: the

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135 Lee Penrod, "Understanding System Memory and CPU Speeds: A Layman's Guide to the Front Side Bus (FSB)," in *Directron.org* (Houston, TX: Directron.org, September 21, 2007), http://www.directron.com/fsbguide.html (accessed May 4, 2009).

136 Roy Longbottom, "Computer Speed Claims, 1980 to 1996," in *Roy Longbottom's PC Benchmark Collection* (United Kingdom: n.d.), http://www.roylongbottom.org.uk/mips.htm (accessed May 4, 2009).

137 Intel Corporation, *8086 16-Bit HMOS Microprocessor Datasheet* (Santa Clara, C.A.: Intel Corporation, September, 1990), http://datasheets.chipdb.org/Intel/x86/808x/datashts/8086/231455-005.pdf (accessed May 5, 2009); Intel Corporation, *80286 Microprocessor with Memory Management and Protection Datasheet* (Santa Clara, CA: Intel Corporation, September, 1993) http://datasheets.chipdb.org/Intel/x86/286/datashts/210253-016.pdf (accessed May 5, 2009); Intel Corporation, *Intel386 DX Microprocessor – 32-Bit CHMOS Microprocessor with Integrated Memory Management Datasheet* (Santa Clara, CA: Intel Corporation, December, 1995), http://datasheets.chipdb.org/Intel/x86/386/datashts/23163011.pdf. (accessed May 5, 2009); Intel Corporation, *80486 Microprocessor Datasheet* (Santa Clara, CA: Intel Corporation, November, 1993), http://datasheets.chipdb.org/Intel/x86/486/datashts/240440-006.pdf (accessed May 5, 2009); Intel Corporation, *Pentium Processor Family Developer's Manual* (Santa Clara, CA: Intel Corporation, 1995), http://datasheets.chipdb.org/Intel/x86/Pentium/24143004.PDF (accessed May 5, 2009).

138 Intel Corporation, *Intel Core 2 Duo Processor E8000 and E7000 Series Datasheet* (Santa Clara, CA: Intel Corporation, June, 2009), http://download.intel.com/design/processor/datashts/318732.pdf (accessed July 4, 2009).

processors now found in cell phones are capable of up to 1,000 MIPS.[139]

Random-access memory (RAM) is the virtual scratch pad in which a computer system stores running software and the variables a program uses to perform calculations. Absent paging or swapping, which writes areas of RAM out to non-volatile or other storage for later retrieval and thus allows the loading of programs or data larger than available physical memory, the total amount of RAM in a system defines the maximum size of a program or data set it can load. Storage capacity, whether in RAM or on disk, is measured in bytes, the basic addressable unit in most computing architectures; depending on system architecture, a byte is an array of six to nine (usually eight) bits, or base two numbers (0 or 1). A standard eight-bit byte can hold one of 256 (2^8) values, usually the number of bits required to represent a single character within a given typographic encoding. This is the equivalent of two base 16 or hexadecimal digits (16^2).

Early microcomputers typically contained between sixteen and 256 kilobytes (kb) of RAM, with a kilobyte holding 1024 (2^{10}) bytes. On IBM PCs, the limit of non-extended RAM was always 640kb, though during the period under study most systems contained between four and 16 megabytes, with one megabyte holding 1024 kilobytes or 1,048,576 (2^{20}) bytes.[140] To provide a reference as per scale, the characters that make up this sentence amount to 98 bytes. Current personal computers usually carry several gigabytes of RAM, with 1024 megabytes in each gigabyte; the operating system in use on IBM PC compatibles during the heyday of BBS art, Microsoft MS-DOS 4.0 or 5.0, only

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[139] Matthieu Weber, *Mobile Hardware* (Jyväskylä, Finland: University of Jyväskylä, March 18, 2009), http://users.jyu.fi/~mweber/teaching/TIEA323/lectures/02-hardware.pdf (accessed May 5, 2009).

[140] David Culler, *EECS252: Graduate Computer Architecture, Memory Trends/Speeds* (Berkeley, C.A.: University of California, July 14, 1998), http://www.eecs.berkeley.edu/~culler/courses/cs252-s05/lectures/cs252s05-lec01-intro.ppt (accessed May 5, 2009; most recent update is October 17, 2010).

required approximately 384kb of memory.[141] By comparison, Microsoft's current version of Windows demands a minimum of one gigabyte of RAM.[142]

Physical storage capacity is also measured in kilobytes, megabytes or gigabytes, but what differentiates it from RAM is the fact that it is external to the CPU-housing motherboard of a microcomputer system, connected as it is by a data bus, and it is non-volatile in that its contents are retained when a system is powered off. Even today, disk storage is predominantly electromagnetic, with optical media like CD-ROMs and DVDs and solid-state devices like flash disks standing as exceptions to the rule. Floppy disks and hard drives store data in the same way; they are named differently because the platter on which data is written is made of either flexible plastic or inflexible glass or metal. Data is stored on disk on a bit-by-bit basis, with the disk head writing a north- or south-polarized segment representing the 0 or 1 in every bit. Collections of bits are encoded into bytes which are allocated into the clusters that are the basic units of disk sectors and disk tracks.

Originally, the storage capacity of all microcomputers was quite modest, with 5¼ inch, 180 kilobyte single-sided floppy disks the norm. These were later expanded to 360kb double-sided disks, 720kb double-sided double-density 3½ inch disks, and eventually 1.2 megabyte 5¼ inch or 1.44 megabyte 3½ inch disks. These were gradually

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[141] EMS Professional Software, *Microsoft DOS Version Features* (Deerwood, M.D.: EMS Professional Software, n.d.), http://www.emsps.com/oldtools/msdosv.htm (accessed May 6, 2009); Operating System Documentation Project, "DOS (Disk Operating System), in *Operating System Documentation Project* (Karlsruhe, Germany: April 14, 2003), http://www.operating-system.org/betriebssystem/_english/bs-msdos.htm (accessed May 6, 2009); Microsoft Corporation, "TechNet: System Requirements for IBM PC-DOS 5.0 Upgrade," in *Microsoft Support* (Redmond, WA: Microsoft Corporation, November 16, 2006), http://support.microsoft.com/kb/75148 (accessed May 6, 2009); Harry McCracken, "Ten Momentous Moments in DOS History," in *PC World* (San Francisco, CA: PCWorld Communications Inc., April 1, 2008), http://www.xs4all.nl/~hwiegman/msdos/75148.htm. (accessed May 6, 2009).

[142] Microsoft Corporation, *Windows 7 System Requirements* (Redmond, WA: Microsoft Corporation, 2009), http://windows.microsoft.com/systemrequirements (accessed May 6, 2009).

complemented by hard disk drives with capacities ranging from five megabytes at the beginning of the 1980s to one gigabyte by 1996, though the standard hard drive size during the early 1990s ranged from 40 to 540 megabytes.[144] Hard drives were initially prohibitively expensive, with ten megabyte disks costing several thousand dollars in the early 1980s, but by the middle of the subsequent decade they had dropped to a price point familiar to contemporary consumers, namely about $250 or so.[145] While current computers are routinely outfitted with disks capable of storing between 100 gigabytes and one to two terabytes, the orders-of-magnitude size differences that separate

Period advertisement for the IBM PC XT, "More power to the person," which was released in March of 1983. Aimed squarely at the corporate market, this advertisement lauds the XT's "10-million-character fixed disk [a hard drive] that gives you the power to pump more productivity into your business," and mentions backwards-compatibility with the original IBM PC as a selling point. Total cost: $5,000, the equivalent of $10,629 in 2009-adjusted dollars. IBM licensed the Charlie Chaplin tramp figure for use in its ad campaigns in the 1980s, believing that it could soften the company's staid image and reduce public fear of computers that might inhibit its entry into the PC market.[143]

[143] I'm afraid I couldn't determine what magazine this originally appeared in. See Dave Dunfield, "IBM 5160 XT," in *Dave's Old Computers* (Carp, Ontario: Dunfield Development Services Inc., 2004), http://www.classiccmp.org/dunfield/pc/h/pc5160ad.jpg (accessed May 6, 2009). For a period television ad, see http://www.youtube.com/watch?v=bQMXIh_7LGQ. All of this is roughly authenticated by Stephen Papson, "The IBM Tramp," in *Jump Cut* 35 (April, 1990): 66-72, http://www.ejumpcut.org/archive/onlinessays/JC35folder/IBMtramp.html.

[144] Ivan Smith, "Historical Notes about the Cost of Hard Drive Space," in *Nova Scotia's Electric Gleaner* (Canning, N.S.: NS1758.CA, November, 1996), http://ns1758.ca/winch/winchest.html (accessed May 6, 2009); Patrick Schmid, "15 Years of Hard Drive History: Capacities Outran Performance," in *Tom's Hardware* (France: Bestofmedia Network, November 27, 2006), http://www.tomshardware.com/reviews/15-years-of-hard-drive-history,1368.html (accessed May 6, 2009).

[145] Larry F. Byard, "Hard Disk Drive Guide: A Brief History of the Hard Drive," in *DUX Computer Digest* (Sanford, ME: Dux Computer Works, 2005) http://www.duxcw.com/digest/guides/hd/hd2.htm (accessed May 6, 2009).

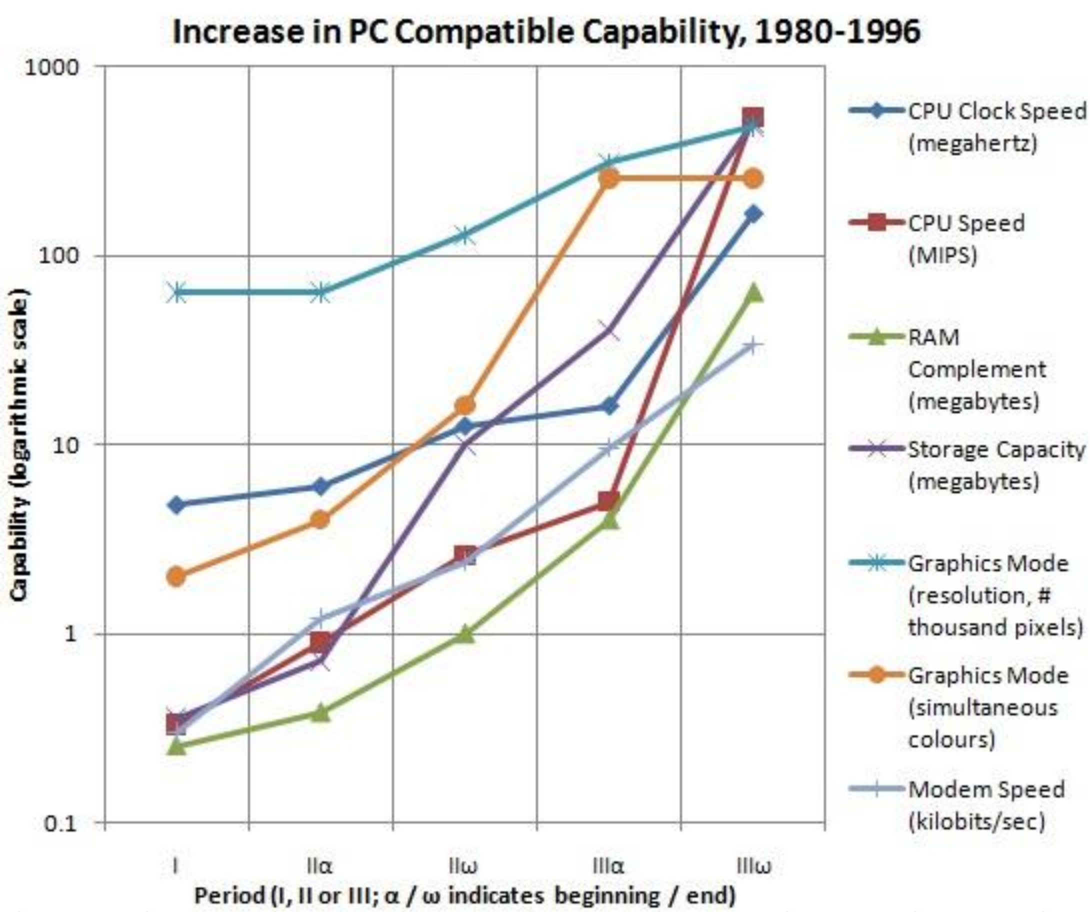
historical microcomputers from their current descendents represent increases that are proportional to increases in program size and data storage requirements. In the early 1990s, Microsoft MS-DOS 5.0 shipped on five 1.2 megabyte floppy disks; in 2010, Windows 7 installs off of a 4.7 gigabyte DVD.

Although the graphics capabilities of IBM PC compatibles and the speeds with which modems available for the platform could access the public switched telephone network will be the subject of extensive commentary in subsequent sections in this chapter, a few brief facts bear mentioning here. First, the graphics modes available on the original IBM PC were almost unbearably crude, with either monochrome monitors, the four-color Colour Graphics Adapter (CGA), or the 16-color Enhanced Graphics Adapter (EGA) defining the system's state of the art throughout the 1980s.[146] Decent high-resolution graphics were not available until the release of the Video Graphics Array (VGA) and Super Video Graphics Array (SVGA) standards in the early 1990s.[147] This did not inhibit the development of BBS artwork, however, as CGA, EGA, VGA and SVGA adapters could all display 16 foreground and eight background colors at a resolution of 80 by 25 or 80 by 50 characters in text mode. Furthermore, the speeds at which these systems could connect to others over the telephone network, which ranged between 37 *characters* of text per second in the early 1980s to 3,700 per second in 1996, were so slow as to make the sending of high-resolution graphics down the line nigh on

[146] International Business Machines, *IBM Personal Computer Technical Reference* (Boca Raton, F.L: International Business Machines, 1983), http://www.retroarchive.org/dos/docs/ibm_techref_v202_1.pdf p.133-158 (accessed May 5, 2009). Charles M. Kozeirok, "Video Display Standards," in *The PC Guide* (Bennington, VT: The PC Guide, 1997), http://www.pcguide.com/ref/video/std.htm (accessed May 5, 2009).

[147] J. D. Neal, "Hardware-Level VGA and SVGA Programming Information Page," in *FreeVGA Project* (Location Unknown: Bona Fide OS Developer, 1998), http://www.osdever.net/FreeVGA/vga/vga.htm (accessed May 4, 2009).

impossible.[148]



From the above, two conclusions present themselves. The first is that the capabilities of microcomputers during the 1980s and early 1990s were vastly less than contemporary computer systems. While the technology required to display digital images, full-motion video, animated vector graphics and high-quality compressed audio existed in nascent form during this period, the processing, memory, physical storage and

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[148] International Telecommunication Union, *V.21: 300 Bits Per Second Duplex Modem Standardized For Use In The General Switched Telephone Network* (Geneva: International Telecommunication Union, 1988), http://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-V.21-198811-I!!PDF-E&type=items (accessed May 7, 2009); International Telecommunication Union, *V.34 : A Modem Operating at Data Signalling Rates of up to 33 600 bit/s For Use on the General Switched Telephone Network and on Leased Point-to-Point 2-Wire Telephone-type Circuits* (Geneva: International Telecommunication Union, 1998), http://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-V.34-199802-I!!PDF-E&type=items (accessed May 7, 2009).

networking capabilities of platforms then in widespread use prevented artistic expression via these now-common media. The second is illustrated most readily by the graph that appears above, which charts improvements in the specifications given in its companion table as they occurred over time. With the exception of modem speed and graphics resolution, represented by the light blue and cyan lines, between 1980 and 1996 everything from CPU processing speed to available RAM to physical storage media displays a growth curve which, when plotted on a logarithmic scale, indicates exponential improvements in platform capability. [149]

In turn, this data set proves two interrelated propositions. First, Moore's Law, which describes capability using the metric of integrated circuit complexity measured against cost and prescribes a growth formula of 2^y where *y* is the number of years in a period divided by two, held true between 1980 and 1996.[150] Second, what best accounts for the vast difference between the capabilities of contemporary computing platforms and those of their antecedents is not a scientific paradigm shift that produced revolutionary technological breakthroughs, but the kind of incremental, value-enhancing improvements that occurred with regularity once the consumer paradigm shift of microprocessor adoption had taken hold.

Despite these monumental increases in capability, text remained the only viable mode of online artistic expression until the dying days of the BBS era. This is because while modems increased in speed throughout the period, they still used the limited

[149] The obvious exception shown in the graph is the number of simultaneous colours that could be displayed by graphics adapters, whose growth curve is flat between periods IIIα and IIIω. This is because once 24-bit "truecolour" (2^{24} or 16,777,216 possible colours) was developed, no further improvement was necessary for the consumer market as the human eye is popularly viewed as only being capable of distinguishing between ten million colours or so.

[150] Intel Corporation, "Moore's Law: Made Real by Intel Innovation," in *Intel Technology* (Santa Clara, CA: Intel Corporation, 2009), http://www.intel.com/technology/mooreslaw/ (accessed May 7, 2009).

frequency range of the acoustic channel of a telephone connection and this could only move data at a maximum speed of 3.5 kilobytes per second.[151] Indeed, the decline of the BBS is explained by the disproportion between the rapid rate of overall improvement in platform capability when compared with the relatively slow rate of improvement in the speed of the networking technologies that were available to home users. While the viability of the microcomputer paradigm remained strong, the viability of the circuit-based, public switched telephone network as a data carrier did not. This introduced inconsistencies in the then-prevalent operating environment that provoked a new consumer paradigm shift – the network-access revolution symbolized by the Internet – in an attempt to overcome these limitations and produce greater market efficiencies through the use of technology.

ASCII, Codepage 437 and ANSI.SYS: Foundations of the Form

When computing technology first achieved widespread adoption within business, government and academia in the 1960s, it became necessary to develop a standard way of encoding Latin characters in binary. This was provided by the American Standard Code for Information Interchange (ASCII), which was originally proposed by the American National Standards Institute (ANSI) in 1963 and finalized in 1968.[152] ASCII defined a seven-bit scheme for representing the characters and control sequences required to display text on digital systems and exchange text between them, providing 128 (2^7) integer values which contained everything from upper- and lower-case letters to

[151] Joseph L. Hammond, Krzystof Pawlikowski and John D. Spragins, *Telecommunications: Protocols and Design* (Reading, MA: Addison-Wesley Publishing Company, 1991): 31-76.
[152] American National Standards Institute, *Information Systems - Coded Character Sets - 7-Bit American National Standard Code for Information Interchange (7-Bit ASCII)* (Washington, DC: American National Standards Institute, 1968).

punctuation, mathematical operators, file and record separators, and spaces, tabs and form-feed (new page) indicators. Seven-bit bytes were used instead of the now-standard eight-bit byte as it represented the smallest number of bits that could hold the 95 printable and 33 non-printable characters required to encapsulate all but the most esoteric texts written in English. The standard was adopted by the United States Federal Government in a memo sent by President Lyndon Johnson to all federal department and agency heads on March 11, 1968, stipulating a final adoption date of July 1, 1969. [153] ASCII remains one of the simplest means of storing text digitally, though pressure to support foreign language encodings within a single character set led to the adoption of Unicode by the late 1990s.[154]

By the time IBM entered the personal computer market in 1981, microprocessors and memory had standardized on the eight-bit byte still in use today. This meant that IBM had space within each standard byte to define an additional 128 printable or control characters for use on its computers. IBM used these to produce proprietary extensions to ASCII in the form of code pages that included supplementary characters for use in foreign-language markets. Under the IBM DOS and MS-DOS operating systems, Codepage 437 was the standard for the United States and other English-language markets; Codepage 858 provided Cyrillic characters in the extended ASCII range, while Codepage 863 was used for Canadian French. Other codepages existed for Greek, Arabic, Portuguese, Turkish, Hebrew, Icelandic, Thai, and the Baltic, Western European,

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[153] Lyndon B. Johnson, "Memorandum Approving the Adoption by the Federal Government of a Standard Code for Information Interchange," in John T. Wolley and Gerhard Peters, *The American Presidency Project [online]* (Santa Barbara, CA: 1999), http://www.presidency.ucsb.edu/ws/index.php?pid=28724 (accessed May 7, 2009).
[154] Julie D. Allen, ed., *The Unicode Standard, Version 5.2* (Mountain View, CA: The Unicode Consortium, 2009).

and Central European language families (Lithuanian, Spanish and Czech, as examples of each). A separate group of codepages provided typographic support for IBM PC-compatibles sold in Asian markets. These were limited to Japanese, Korean and Chinese, with the last requiring double-byte character support (2^{16} bits) from the operating system to provide a truly usable set of logograms.[155]

	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
00	NUL 0000	STX 0001	SOT 0002	ETX 0003	EOT 0004	ENQ 0005	ACK 0006	BEL 0007	BS 0008	HT 0009	LF 000A	VT 000B	FF 000C	CR 000D	SO 000E	SI 000F
10	DLE 0010	DC1 0011	DC2 0012	DC3 0013	DC4 0014	NAK 0015	SYN 0016	ETB 0017	CAN 0018	EM 0019	SUB 001A	ESC 001B	FS 001C	GS 001D	RS 001E	US 001F
20	SP 0020	! 0021	" 0022	# 0023	$ 0024	% 0025	& 0026	' 0027	(0028	) 0029	* 002A	+ 002B	, 002C	- 002D	. 002E	/ 002F
30	0 0030	1 0031	2 0032	3 0033	4 0034	5 0035	6 0036	7 0037	8 0038	9 0039	: 003A	; 003B	< 003C	= 003D	> 003E	? 003F
40	@ 0040	A 0041	B 0042	C 0043	D 0044	E 0045	F 0046	G 0047	H 0048	I 0049	J 004A	K 004B	L 004C	M 004D	N 004E	O 004F
50	P 0050	Q 0051	R 0052	S 0053	T 0054	U 0055	V 0056	W 0057	X 0058	Y 0059	Z 005A	[005B	\ 005C	] 005D	^ 005E	_ 005F
60	` 0060	a 0061	b 0062	c 0063	d 0064	e 0065	f 0066	g 0067	h 0068	i 0069	j 006A	k 006B	l 006C	m 006D	n 006E	o 006F
70	p 0070	q 0071	r 0072	s 0073	t 0074	u 0075	v 0076	w 0077	x 0078	y 0079	z 007A	{ 007B	| 007C	} 007D	~ 007E	DEL 007F
80	Ç 00C7	ü 00FC	é 00E9	â 00E2	ä 00E4	à 00E0	å 00E5	ç 00E7	ê 00EA	ë 00EB	è 00E8	ï 00EF	î 00EE	ì 00EC	Ä 00C4	Å 00C5
90	É 00C9	æ 00E6	Æ 00C6	ô 00F4	ö 00F6	ò 00F2	û 00FB	ù 00F9	ÿ 00FF	Ö 00D6	Ü 00DC	¢ 00A2	£ 00A3	¥ 00A5	₧ 20A7	ƒ 0192
A0	á 00E1	í 00ED	ó 00F3	ú 00FA	ñ 00F1	Ñ 00D1	ª 00AA	º 00BA	¿ 00BF	⌐ 2310	¬ 00AC	½ 00BD	¼ 00BC	¡ 00A1	« 00AB	» 00BB
B0	░ 2591	▒ 2592	▓ 2593	│ 2502	┤ 2524	╡ 2561	╢ 2562	╖ 2556	╕ 2555	╣ 2563	║ 2551	╗ 2557	╝ 255D	╜ 255C	╛ 255B	┐ 2510
C0	└ 2514	┴ 2534	┬ 252C	├ 251C	─ 2500	┼ 253C	╞ 255E	╟ 255F	╚ 255A	╔ 2554	╩ 2569	╦ 2566	╠ 2560	═ 2550	╬ 256C	╧ 2567
D0	╨ 2568	╤ 2564	╥ 2565	╙ 2559	╘ 2558	╒ 2552	╓ 2553	╫ 256B	╪ 256A	┘ 2518	┌ 250C	█ 2588	▄ 2584	▌ 258C	▐ 2590	▀ 2580
E0	α 03B1	ß 00DF	Γ 0393	π 03C0	Σ 03A3	σ 03C3	µ 00B5	τ 03C4	Φ 03A6	Θ 0398	Ω 03A9	δ 03B4	∞ 221E	φ 03C6	ε 03B5	∩ 2229
F0	≡ 2261	± 00B1	≥ 2265	≤ 2264	⌠ 2320	⌡ 2321	÷ 00F7	≈ 2248	° 00B0	∙ 2219	· 00B7	√ 221A	ⁿ 207F	² 00B2	■ 25A0	NBSP 00A0

Character chart showing both standard ASCII (00-7F) and IBM Codepage 437 extended ASCII glyphs (80-FF) in hexadecimal notation. Unicode equivalents appear beneath each character.[156]

[155] International Business Machines, *Code Page Identifiers* (Aramonk, NY: International Business Machines, n.d.), http://www-01.ibm.com/software/globalization/cp/cp_cpgid.html (accessed May 7, 2009).
[156] Microsoft Developer's Network, "OEM 437," in *MSDN Technical Reference* (Redmond, WA.: Microsoft Corporation, 2010) http://msdn.microsoft.com/en-us/goglobal/cc305156.aspx (accessed May 7, 2009).

The historical quirk responsible for the form of BBS artwork was IBM’s decision to include nine text-mode block drawing characters in Codepage 437 along with a host of other line, pipe and box-drawing glyphs. Because English is written phonetically and has no accented characters or special punctuation marks, Codepage 437 contained the largest amount of free space that could be allocated to the encoding of non-standard glyphs like the block-drawing characters seen at the right. Over fifty such glyphs appear in the standard. Of significance to the use of the subset of nine block characters in art, however, was the fact that they persisted with the same ordinal values across nearly all non-Asian IBM codepages, meaning that an artwork that used these characters could be displayed on an IBM PC-compatible in use throughout most of the world. The same was not true of the line, pipe

IBM Text Mode Block Drawing Characters

Glyph	Integer / Hex Value	Description
░	176 / B0	Light Shade
▒	177 / B1	Medium Shade
▓	178 / B2	Dark Shade
█	219 / DB	Full Block
▄	220 / DC	Lower Block
▌	221 / DD	Left Half Block
▐	222 / DE	Right Half Block
▀	223 / DF	Upper Block
■	254 / FE	Black Square

IBM Text-mode drawing characters originally featured in Codepage 437 and all other non-Asian codepages. CP437, used in most English-speaking countries, had the most extensive set of text-mode drawing characters at over fifty. The characters here appear in “IBM Grey,” (Red-Green-Blue mix 170/170/170), which was the default on all colour monitors.

and box-drawing glyphs.

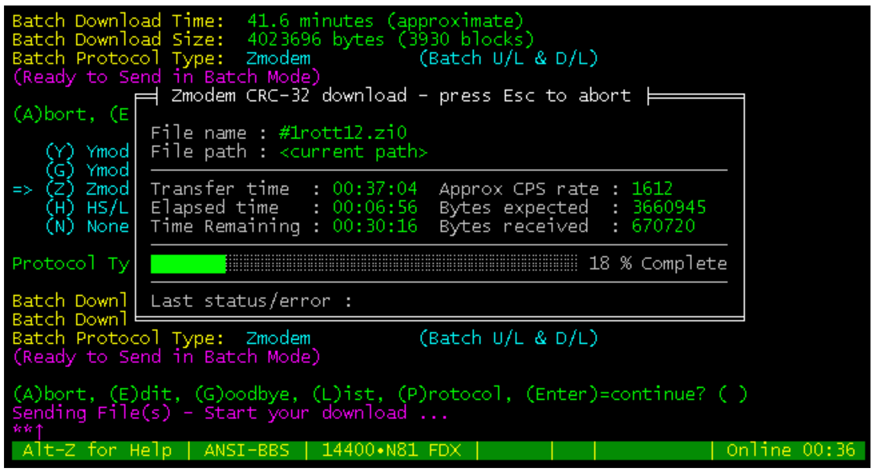
Codepage 437 and ANSI.SYS defining the form of the interface: Main Menu from Stone Angel of art group UNiON's menu set for the Renegade BBS Software, released in UNiON's May, 1994 art pack. Although most of the graphical portion of the design uses the standard CP437 block drawing glyphs, the horizontal lines that appear both below and at the side of "Main Menu" were created with the box-drawing characters.[157]

To add colour to text, change the background colour, move the cursor around the screen and use it to shade portions of the display, an additional interface layer was needed. This came in the form of ANSI.SYS, a device driver that shipped with the DOS operating system that was the standard on PC-compatibles before its replacement by various species of Microsoft Windows. Invoked when a computer first booted up, ANSI.SYS implemented a partial set of the functions defined in the X3.64 text terminal control standard originally proposed by the X3L2 Technical Committee on Codes and Character Sets of the American National Standards Institute.[158] When enabled,

[157] Stone Angel, "Renegade BBS Menu Set," in *UNiON, May, 1994* (Location Unknown: May, 1994), http://www.textfiles.com/artscene/artpacks/1994/uni-0594.zip (accessed April 14, 2009).

[158] K. Weatherington, "The Story of PLP," in *Selected Areas in Communications, IEEE Journal* 1 (issue 2, February, 1983): 267-277. For the complete standard, see Paul Bourke, *ANSI Standard (X3.64) Control Sequences For Video Terminals and Peripherals in Alphabetic Order by Mnemonic* (Crawley, Australia:

ANSI.SYS would translate so-called escape sequences – strings of characters formatted according to the specification – into hardware commands that moved the cursor around the screen and changed the foreground and background colours of text. Control sequences consisted of ASCII escape character (decimal character #27, typically invisible but rendered as ← on IBM PC-compatibles running DOS) followed by a left square bracket ([ ) and a sequence of alphanumeric characters that indicated the desired function and the parameters that it required.



Telix, a BBS dialler software that was widely used between the late 1980s and mid-1990s. The user is connected at 14,400 baud, is using colour ANSI terminal emulation as indicated in the status bar, and is downloading a file using the ZModem transfer protocol.[159]

On PC-compatibles, ANSI.SYS only had to be loaded if one wished to view files containing ANSI escape sequences from the computer console or command prompt. When dialling up a BBS, third-party communications applications controlled the connection and interpreted ANSI codes sent down the line through their own ANSI interpreters, a process known as terminal emulation. Dialler software also typically implemented phone book, screen capture and logging functionality and the suite of various protocols required to transfer binary files between systems. As with most

University of Western Australia, March 1989), http://local.wasp.uwa.edu.au/~pbourke/dataformats/ascii/ (accessed April 14, 2009).

[159] DeltaComm Development Inc., *Telix Version 3.51* (Raleigh, NC: May 1, 1996), http://www.telix.com/ftp/telix/telix351.zip (accessed November 5, 2009).

software used on the IBM PC, these programs operated in text mode at the standard 80x25 or 80x50 resolution, and drew their interface with the same Codepage 437 drawing characters used in BBS art.

Common ANSI.SYS Control Sequences

Sequence	Parameters	Function	Example
←[P_1; . . . P_nm	P: integer, 0-47	Set foreground / background colours and text attributes	←[1;37;44m Set high-intensity (bold) text, white foreground on blue background
←[P_{Row};P_{Col}H	$P_{Row:}$ integer, 1-25/50 $P_{Col:}$ integer, 1-80	Set cursor position	←[20;4H Move cursor to 20th row, 4th column on screen
←[P_1A	P: integer, # rows	Move cursor up	←[5A Move cursor up five rows
←[P_1B	P: integer, # rows	Move cursor down	←[22B Move cursor down 22 rows
←[P_1C	P: integer, # columns	Move cursor left	←[14C Move cursor left 14 columns
←[P_1D	P: integer, # columns	Move cursor right	←[9D Move cursor right 9 columns
←[2J	None	Clear Display	←[2J
Complex Example: ANSI-Interpreted Text		**ANSI-Escaped Equivalent (visible text in bold, colorized)**	
 ANSi By: The Necromancer [iCE] '93 (from "CILI Code][" advertisement, iCE, August 1993)		←[0;1m**A**←[0m**NS**←[0;1;30m**i** ←[0;1m**B**←[0m**y** ←[0;1;30m**:** ←[0;1m**T**←[0;1;31m**h**←[0;31m**e** ←[0;1m**N**[0;1;33m**e**←[0;1;31m**cr**←[0;31m**oma**←[0;1;31m**nc**←[0;1;33m**e**←[0;1m**r** ←[0;1;30m**[**←[0;1m**i**←[0;1;36m**C**←[0;36m**E**←[0;1;30m**]** ←[0;1m**'**←[0m**9**←[0;1;30m**3**	

Without the interpretation provided by either ANSI.SYS or terminal emulation, BBS artwork would have appeared as scarcely-comprehensible gibberish, a combination of unprintable control characters, square brackets, semicolons, and extended ASCII blocks. Other means of sending coloured text down the line existed in the form of competing screen protocols, from the VT-series used on Digital Equipment Corporation's mainframe-oriented terminals to the Advanced Video Attribute Terminal Assembler and Re-creator (AVATAR), a standard defined by the FidoNet Technology Committee, but these did not gain traction because they were either directed at the corporate market or introduced later than ANSI.[160] Few could effectively compete with the level of operating system and dialler program support for ANSI, which had been in existence since 1982. So complete was ANSI's domination of text-mode colour graphics display on PC-compatibles that the term "ANSI" still stands as a synonym for BBS artwork to this day. Other microcomputer platforms that lacked the block-drawing shapes of Codepage 437 developed their own forms of BBS artwork, but these tended towards the use of non-extended ASCII characters (ASCIIs instead of ANSIs) to ensure compatibility between competing platforms.

Sixteen Glorious Colours

The IBM PC, PC-compatible siblings and their descendants did not typically ship with integrated graphics adapters. Instead, the purchaser was given the choice between one of two graphics cards installed in one of the PC's expansion slots: the Monochrome Display Adapter, which took 80x25 two-color text mode as its default, or the Colour Graphics Adapter at 40x25 or 80x25 in 16-colour text mode.[161] 16-colour 80x25 resolution remained the text mode standard even after the development of EGA, VGA and SVGA, with inter-generational enhancements providing improved high-resolution graphics modes while leaving text mode unchanged. Text mode included eight per-

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[160] George A. Stanislav, *AVATAR: Advanced Video Attribute Terminal Assembler and Recreator* (Pittsburgh, PA: Fidonet Technical Standards Committee, August 23, 1988), http://www.ftsc.org/docs/fsc-0025.001 (accessed December 4, 2009).

[161] International Business Machines, *Press Release: Personal Computer Announced by IBM* (New York: August 12, 1981), http://www-03.ibm.com/ibm/history/documents/pdf/pcpress.pdf (accessed July 2, 2010).

character background colours which replicated the first eight foreground colours.

While the video memory of early colour graphics cards allowed for full 16-colour backgrounding, this could only be accomplished by the non-standard practice of disabling the single bit on each printed character that was devoted to the "blink" text attribute.[162] All cards, whether monochrome or not, were capable of rendering colourized ANSI graphics and processing the hardware commands invoked through ANSI escape sequences, as monochrome adapters used changes in intensity or additional text accents like underlines to identify specific colours on two-colour displays.

The chroma, hue and intensity of these colours changed little across subsequent generations of graphics cards, though the sharpness of the character rendering in CGA was less than that of EGA, VGA or SVGA, all of which displayed Codepage 437 identically. As is demonstrated by the example that appears below, which was created using software

16-Colour IBM PC / ANSI Palette

Colour	Name	RGB /ANSI Notation
	Black	0,0,0 ←[0;30m
	Blue	0,0,170 ←[0;34m
	Green	0,170,0 ←[0;32m
	Cyan	0,170,170 ←[0;36m
	Red	170,0,0 ←[0;31m
	Magenta	170,0,170 ←[0;35m
	"Yellow" (Brown)	170,85,0 ←[0;33m
	Gray	170,170,170 ←[0;37m
	High-Intensity Black	85,85,85 ←[1;30m
	High-Intensity Blue	85,85,255 ←[1;34m
	High-Intensity Green	85,255,85 ←[1;32m
	High-Intensity Cyan	85,255,255 ←[1;36m
	High-Intensity Red	255,85,85 ←[1;31m
	High-Intensity Magenta	255,85,255 ←[1;35m
	Yellow	255,255,85 ←[1;33m
	White	255,255,255 ←[1;37m

The palette shown here represents the full range of text-mode colours that could be used on IBM PC-compatibles. The eight background colours were the same as the first eight low-intensity foreground colours. These were set by passing integer values between 40 and 47 to the ANSI *m* function.

[162] John Elliott, "Colour Graphics Adapter: Notes" in *John Elliott's Homepage* (United Kingdom: December 6, 2006), http://www.seasip.info/VintagePC/cga.html (accessed May 5, 2009); an excellent hardware reference to the IBM 5271/3270 PC can be found at John Elliott, "The IBM 5271 (aka. 3270 PC)," in *John Elliott's Homepage* (United Kingdom: April 8, 2008), http://www.seasip.info/VintagePC/5271.html (accessed May 5, 2009).

emulation of CGA and VGA hardware, CGA text mode was noticeably blockier. This is

"Allegiance" logo, drawn by Magnus for iCE's February, 1994 artpack. **Top:** Logo as it would have appeared on 16-color 80x25 CGA hardware. **Bottom:** Logo as it would have appeared on 16-color 80x25 VGA hardware.[163]

because CGA Red-Green-Blue-Intensity (RGBI) monitors used non-square pixels at a lower dot pitch (pixels per millimetre) than subsequent displays, resulting in per-

[163] Magus, "Allegiance Logo," in *iCE Productions February, 1994 iCEPack* (Location Unknown: iCE Productions, May, 1994), http://www.textfiles.com/artscene/ice/icepacks/1994/ice-9405.zip (accessed June 7, 2009).

character aspect ratio distortions.[164] Whether Magnus' "Allegiance" image advertised a BBS or a Fidonet-style message network between BBSes is unclear, but its "We Pledge Alleginace [sic] to the Net" evokes an effective *double-entendre* by speaking to loyalty to both the system / network as a technological installation and the alterity between real-life and digital representations of identity that it enabled.

The images presented here show coloured, high-contrast text displayed against a black background. This was the default display mode for all IBM PC-compatibles and nearly all microcomputers, the Commodore 64 standing as one of the few exceptions.[166] As cathode ray-tube monitors were the only available display technology, this meant that ANSIs were backlit, phosphorescent pictures in which each individual character was strongly illuminated: the sixteen colour palette piercingly attracted the eye when juxtaposed against the pure black contrast of the CRT. Modern liquid crystal (LCD) displays boast contrast ratios between 700:1 and 8,000,000:1 on high-end equipment, but their method of painting individual

"Kaoz," drawn by Kyp for iCE's November, 1996 art pack. The work, which is 184 lines long, has been scaled down to fit on the page.[165]

[164] Raymond Chen, "My Life as a Square (Pixel)," in *The Old New Thing* (blog), June 25, 2010, http://blogs.msdn.com/b/oldnewthing/archive/2010/06/25/10029898.aspx (accessed July 6, 2010).
[165] Kyp, "Kaoz," in *iCE Productions November, 1996 iCEPack* (Location Unknown: iCE Productions, November, 1996), http://www.textfiles.com/artscene/ice/icepacks/1996/ice9611a.zip (accessed June 4, 2009).
[166] Commodore Business Machines Inc., *Commodore 64 User's Guide, Chapter 5: Advanced Color and Graphic Commands.* (New York: Howard W. Sams & Co., 1982), http://www.commodore.ca/manuals/c64_users_guide/c64-users_guide-05-advanced_color_graphic_commands.pdf (accessed May 7, 2009).

pixels works by sending white light through polarizing filters to produce colour.[167] "Black" is thus the product of filtering rather than the default, non-activated background, a fact that explains why CRT contrast ratios are theoretically infinite when they are not affected by glare introduced by ambient light.[168] When viewed in a darkened room, CRT black looks *black*; under the same conditions, LCDs display white bleed-through and edge-illumination artefacts, and the trueness of their colour rendition is always worse. Finally, CRT refresh rates are better than those of the best LCDs as the entire screen is continuously repainted at 60 hertz or more. LCDs take between two and 32 milliseconds to trigger individual pixels, and the size difference between a stream of electrons striking a grilled phosphor target and that of a larger, crystal molecule makes LCD pixels larger and blockier.[169]

The effect of all of this was to make the viewing of ANSIs more captivating and immersive than other graphic formats. To this is added another factor unique to the presentation of ANSIs on bulletin board systems, namely the fact that BBSes were viewed in black-backgrounded terminal software that lacked the user interface gumdrops typical of modern windowed operating systems. Modern operating systems capture the foreign within the framework of the familiar by displaying information within the common borders of individual windows; when one connects to an Internet site, one views it within a display paradigm that imposes local order on remote data by presenting it through the viewport of an application's window. Interface persistence grounds

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[167] George Ou, "How LCD Makers Inflate Their Contrast Ratio Scores," in *Real World IT* (blog), December 23, 2007, http://www.zdnet.com/blog/ou/how-lcd-makers-inflate-their-contrast-ratio-scores/935 (accessed May 7, 2009).
[168] "Elements of Picture Quality," in *HDTV Test* (United Kingdom: HDTV Test, 2007), http://www.hdtvtest.co.uk/Article/Elements-Of-Picture-Quality.php (accessed May 8, 2009).
[169] Tomi Engdahl, "VGA to Workstation Monitor FAQ," in *ePanorama.net* (Helsinki: ePanorama.net, 2007), http://www.epanorama.net/documents/vga2rgb/interfacing.html (accessed May 8, 2009).

everything in the *here*: the data used to display a page might be from anywhere in the world, but it is always filtered through local visual conventions. In contrast, when one connected to a BBS its interface filled the screen out to the edges of the monitor and left untouched only the terminal software's one-line status bar at the bottom of the display. A BBS was viewed in the unfamiliar *there*, the null space of the connection, with the user being drawn in to a system rather than having the system's data fitted to a canvas that always contained local inflections. Systems outfitted with a unique array of ANSI artwork, which was common signifier of elite status within the pirate community, were worlds unto themselves – secret, *sub rosa* societies that unified form and system outside the boundaries of the familiar.

The sixteen colours and nine drawing characters detailed above were fixed, technological constraints within which all ANSI art had to be drawn. The Allegiance logo uses only white, gray, low- and high-intensity cyan and high-intensity black; Stone Angel's Renegade menus (see p.104) use the same limited color set to produce a markedly different artwork. Thus far, many of the artworks showcased here have been smaller than the 25 or 50 rows that were the length limit of text mode, but even early ANSIs frequently exceeded the vertical limit of the screen. Images longer than the screen length were shown not by altering their scale, a feat that was impossible without redrawing them in graphics mode, but instead by scrolling the images vertically. As a new line appeared at the bottom of the display, the top line would be deleted and all the rows would be shifted upwards by one in order to draw the new data.

In addition, these images were not drawn all at once; instead, individual characters were drawn left-to-right as the file was read from the BBS' local disk and sent down the telephone line at whatever speed governed the connection between the two computers. An equivalent effect is familiar to all those who have used a typewriter or seen an old dot-matrix printer in action: text is written left-to-right and top-to-bottom, with each new line appearing beneath the last as quickly as the hardware allows. One would thus see an ANSI re-drawn on a line-by-line basis every time it was viewed on a BBS, and one could not know the final content of an artwork until all of it had scrolled down the screen. In their natural environment, longer artworks were thus displayed as a series of constantly shifting 80 by 25 or 80 by 50 snapshots, a mode of display far from the all-at-once instantaneousness of images hung in a gallery. The eye of the viewer adhered to the movement of the blinking cursor, resulting in a line-by-line construction of imagistic sentiment more akin to the reading of poetry than traditional means of viewing visual art.

"Confusion," drawn by Gangstar for ACiD's May, 1995 artpack. Original size: 80 x 149 lines.[170]

[170] Gangstar, "Confusion," in *ACiD: The Acquisition, May, 1995* (Location Unknown: ACiD Productions, May, 1995), http://www.textfiles.com/artscene/acid/ARTPACKS/1995/acdu0595.zip (accessed June 4, 2009).

Commoditized Hardware and the Open Market: Drivers of Technological Development

As detailed in previous chapters, the IBM's path to platform dominance in the microcomputer market was as much the product of inadvertence as it was a function of IBM's market pre-eminence in business computing. To make up for its late entry into the market, design shortcuts in the form of the use of commercial, off-the-shelf components allowed other companies to copy the PC platform and create IBM-compatible personal computers that eventually accounted for the vast majority of systems sold. IBM also sought to capture the spirit of hobbyist and third-party microcomputer innovation by building its system around a standard, well-documented interface, the ISA bus, which allowed other companies to design peripherals and expansion boards for the platform. Like Apple and Commodore, every IBM PC shipped with a detailed technical reference manual that explained the quirks of the architecture to encourage its adoption by third-party peripheral and software developers.

This third-party market was the motive force behind the exponential increases in PC-compatible capability between the emergence of the platform in 1980 and 1996, the end of the period under study. These improvements touched everything from processor speed and memory capacity to the resolution and quality of graphics that could be displayed on the screen. With an open architecture buttressed by manufacturers adhering to backwards-compatibility as a matter of market necessity, third-party developers were free to push and even exceed what were perceived to be the upper limits of the platform, a fact that explains why many personal computers in use today still use the same family of processors, instruction sets and types of interconnects that originally appeared on the IBM PC. As with everything else, ANSI artwork was equally affected by these changes:

designs become longer, more detailed and more complex as enhanced graphics and what were then considered high-speed modems came to define the minimum capabilities of PC-compatibles then in use.

Text Mode, VGA and Drawing Programs

IBM's attempt to recapture the personal computer market in the face of the rise of the clones took the form of the Personal System/2 (PS/2), introduced in 1987.[171] Along with the ill-fated Microchannel Architecture, which represented IBM's attempt to control the peripherals market by introducing a new, patent-exclusive, unlicensable interconnect designed to supersede ISA, the PS/2 sported IBM's new Video Graphics Array display subsystem.[172] The VGA adapter was capable of graphics mode resolutions of 320 by 200 pixels with 256 simultaneous colours or 640 by 480 pixels and sixteen colours. The 3½ inch floppy disk drive made its appearance as a built-in standard component and many PS/2 systems eventually shipped with internal hard drives, though early models still worked primarily from floppy disks due to their comparatively modest cost. The two-button, relatively un-ergonomic PS/2 mouse was also standard equipment, a design decision that spoke to the increased prevalence of both graphical user environments (GUIs) and text mode applications that used pointing devices. As VGA represented the last time IBM set a display standard that third-party manufacturers of graphics adapters adhered to, 640 by 480 graphics mode remains the basic resolution of all personal computer graphics adapters to this day, much as the 15-pin D-sub VGA connector

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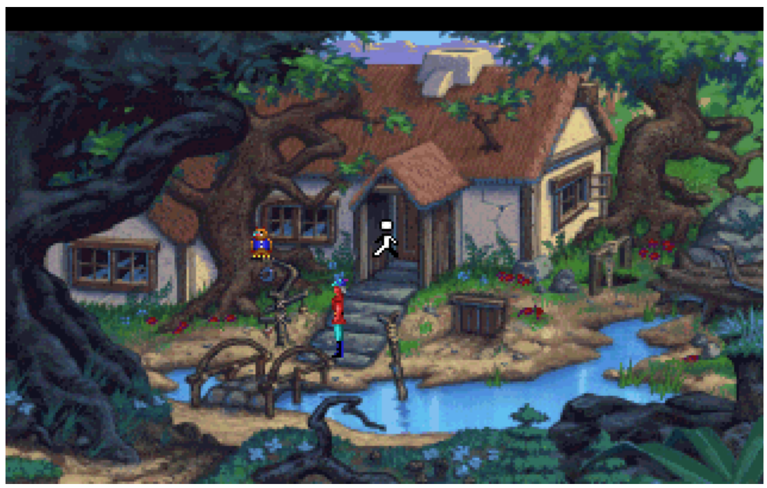
[171] International Business Machines, "PC's Debut Reference Room; The First 10 Years," in *IBM Archives* (Aramonk, NY: n.d.), http://www-03.ibm.com/ibm/history/exhibits/pc25/pc25_tenyears.html (accessed May 8, 2009).
[172] Charles M. Kozierok, "Micro Channel Architecture (MCA) Bus," in *The PC Guide* (Bennington, VT: The PC Guide, 2001), http://www.pcguide.com/ref/mbsys/buses/types/olderMCA-c.html (accessed May 8, 2009).

remained the standard PC-to-monitor interconnect until its recent displacement by DVI and HDMI. More important to ANSI art, however, was the fact that 16-color 80 by 25-character text mode continued to act as the low-resolution standard on VGA systems.



Top: "King's Quest III: To Heir is Human," released in 1986 by Sierra On-Line and running in 320x200 four-colour CGA. Dithering is used to provide the appearance of extra colours, but at the expense of perceived sharpness.
Bottom: "King's Quest V: Absence Makes the Heart Go Yonder," released in 1990 by Sierra On-Line and displaying vastly improved 640x400 256-colour VGA graphics. The monochrome icon at the centre of the image is the pointer for the game's mouse-driven user interface.[173]

The significance of the PS/2 lies in its use in identifying the hardware standards to which IBM PC clones were expected to adhere by 1990-1992, especially with respect to graphics capabilities. As with everything else IBM, hardware manufacturers like Trident, S3, Oak Technologies, Paradise (a division of Western Digital) and Cirrus Logic quickly introduced their own VGA-compatible graphics cards to compete in the clone market IBM had sought to eliminate with the PS/2. These plugged into the Industry

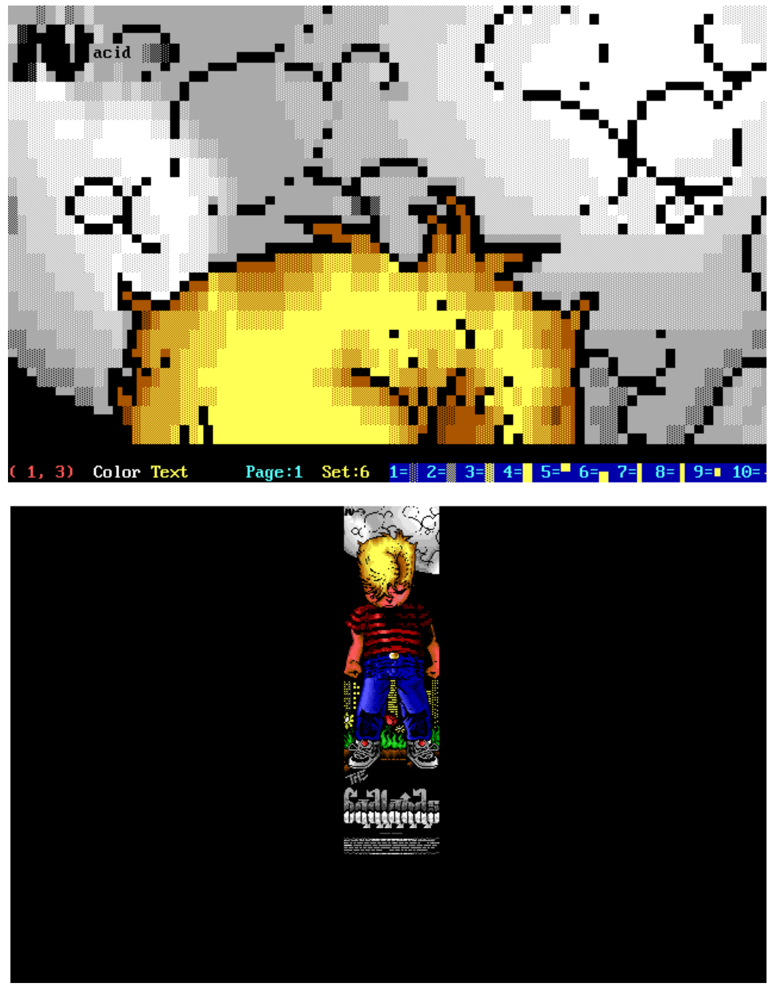
[173] Kat, "King's Quest III Game Mainpage," in *Sierra Planet* (Addison, TX: Sierra Planet, n.d.), http://www.sierraplanet.com/kingsquest3/index.html (accessed June 12, 2009); Kat, "King's Quest V Game Mainpage," in *Sierra Planet* (Addison, TX: Sierra Planet, n.d.), http://www.sierraplanet.com/kingsquest5/index.html (accessed June 12, 2009).

Standard Architecture (ISA) slots found on all PC-compatibles, continuing the established tradition of allowing PC users to incrementally upgrade their systems using inexpensive, modular components. By 1992, the beginning of the golden age of ANSI art, VGA was standard on nearly all computers. VGA adoption was driven by the prevalence of the Microsoft Windows GUI, which achieved maturity when version 3.0 was released on 1990, as well as the fact that by the same year all most games had adopted 256-colour VGA mode as their standard resolution.[174] Regardless, what few older systems still used CGA or EGA were just as capable of viewing ANSIs at their native resolution and colour depth.

The use of ANSI.SYS or terminal emulation to convert coded text into coloured characters meant that "drawing" artworks manually as raw text files was a rarity. Instead, ANSI editing software allowed artists to work by painting characters on the screen with the keyboard and mouse and then outputting the created artwork as an ANSI. TheDraw, written by Ian Davis in 1986, was the application most frequently used for this purpose, but it carried with it a significant technical limitation: the maximum canvas size it allowed was 80 by 50 characters.[175] Beginning in 1993, art groups like ACiD, iCE and others released their own drawing applications (predictably named ACiDDraw and iCEDraw) which permitted the creation of artworks up to 1,000 lines in length. This second generation of editing software, which was complemented by equivalent ANSI viewing applications, took advantage of the prevalence of VGA to allow users to view

[174] Microsoft Corporation, "Windows Desktop Products History," in *Windows History* (Redmond, WA: Microsoft Corporation, June 30, 2002), http://www.microsoft.com/windows/winhistorydesktop.mspx (accessed June 12, 2009).
[175] Ian Davis, *TheDraw version 4.63* (Fremont, CA: TheSoft Programming Services, October 18, 1993), http://www.simtel.net/product/view/id/49632 (accessed November 5, 2008).

and create artworks in its standard 320 by 200 or 640 by 480 graphics modes.[176] Once unofficial third-party extensions to the VGA standard resulted in Super Video Graphics Array (SVGA) adapters entering the market, artworks could be drawn and displayed in resolutions as high as 1024 by 768 pixels. Artists were free to create images far longer than they had previously been able; users were given a new way to view BBS art, one which transformed text-mode characters into graphics-mode pixels. These programs also allowed users to bi-directionally scroll through artworks using the arrow keys on the keyboard, freeing them from the unidirectional top-to-bottom scrolling that was a fixed limit of the



Top: "The Badlands," drawn by Inner Vision for ACiD's July, 1995 artpack. The picture is being edited in text mode in TheDraw, so only the first 25 lines are visible. The user could scroll the cursor down to the preset maximum of 50 lines, but editing beyond that length was impossible.
Bottom: The same artwork as seen in ACiDDraw's 640x480 VGA graphics mode, which the artist suggests ("ps: View it in VGA if possible") is how it should be viewed. The effects of shading and perspective are far more obvious when the image is shown in high resolution.[177]

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[176] Sinned Soul and Skull Leader, *ACiDDraw Version 1.2* (Location Unknown: ACiD Productions, August 1, 1995), ftp://archives.thebbs.org/ansi_utilities/adraw120.zip (accessed November 5, 2008).
[177] Inner Vision, "The Badlands," in *ACiD: The Acquisition, July, 1995* (Unknown Location: ACiD Productions, July, 1995), http://www.textfiles.com/artscene/acid/ARTPACKS/1995/acdu0795.zip (accessed June 4, 2009).

BBS.

None of this software would have been created absent a pressing reason for art groups to do so. It is notable that enhanced drawing programs like ACiDDraw only appeared once the formation of art groups within the BBS scene had matured to the point that the sophistication of artworks, themselves the product of inter-group rivalry and competition for status within the scene, pushed up against the limitations of earlier editing software like TheDraw. Given that the technological substrate that permitted this form of expression was only enhanced by the advent of technologies like VGA rather than eclipsed by it – for the rise of VGA and the adoption of the computer mouse allowed the creation of high-resolution bitmapped images as well – it is a mistake to attribute developments in the form to the adoption of new technology alone. Much like the development of the PC market itself, ANSI creation was a combined techno-social phenomenon: while platform defines the flexible limit of what can be done with available computing resources, its use as an explanation of *why* it was done is restricted to an exposition of why it happened to be done in this way.

"Neo Tokyo," drawn by Somms for ACiD's October, 1994 artpack. Original size: 80 x 202 lines.[178]

This relationship is illustrated by the operation of another

[178] Somms, "Neo Tokyo," in *ACiD: The Acquisition, October, 1994* (Location Unknown: ACiD Productions, October, 1994), http://www.textfiles.com/artscene/acid/ARTPACKS/1994/acdu1094.zip (accessed June 4, 2009).

oft-referenced platform constraint, namely that until the emergence of the Internet as the preferred consumer network, both ANSIs and BBSes retained their vitality. They did so because they remained the most efficient, economical, and readily accessible means of allowing users to organize themselves into communities that provided place, meaning, identity and power to those who participated in them. From the perspective of the market, this is not a "problem" whose solution by this class of users resulted in improvements in the production of goods or the enhancement of value – quite the opposite, in fact, given that underground BBSes were incubators for all kinds of illegal activity – but only the most dismal of liberal economists would hold that human beings are mere automatons of efficiency. That creative expression takes a virtually unlimited number of forms and permutations ultimately demonstrates the subjectivity of value and advantage-seeking behaviour, where the cultural constraints insert themselves between what is sought and how it is acquired.

Modems and Networks

Throughout the period under study, the analog modem remained the predominant – indeed, only – consumer-grade means of information interchange between microcomputer systems, and the circuit-based telephone network used by modems continued to act as the network of choice. As with all personal computer peripherals, modems increased in capability while dropping in price throughout the 1980s and 1990s. A 300 baud modem, which could transfer data at the glacial pace of 37.5 eight-bit characters per second, cost several hundred dollars in the early 1980s; a 33,600 baud modem that could move approximately four kilobytes of data per second cost roughly

$250 in 1995.[179] In 2010, these devices can be had for $20 or less, but this price is more reflective of the obsolescence of the technology rather than any great improvement in the efficiency of modem manufacturing techniques. In contrast, most contemporary consumer Internet connections use either Asynchronous Digital Subscriber Line (ADSL) or cable television networking technologies, connect to computers through Ethernet network adapters rather than modems, and employ the full frequency range of their physical transport media to deliver data at speeds between 256 kilobits (32 kilobytes) and five megabits (650 kilobytes) per second.[180] They are also connection-based rather than circuit-based, meaning that the limit on the number of simultaneous connections they can carry is defined by their overall bandwidth rather than the number of channels ("lines") available to them.

Unsurprisingly, the jump between the 300/1200/2400 baud modems of the 1980s and their 9600 to 33,600 baud siblings in the 1990s was encouraged by the widespread adoption of another technology that originally appeared on the IBM PS/2. This was the 16550 First-In First-Out (FIFO) Universal Asynchronous Receiver and Transmitter (UART). Like many components used by IBM in its designs, this was manufactured by National Semiconductor Corporation, a third party.[181] It replaced the earlier 8250 and 16450 UARTs, chips designed to control communications between an attached serial device like a modem and the microprocessor brains of personal computer systems. 8250

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[179] USRobotics, "History of USRobotics Modems," in *USRobotics Education* (Schamburg, IL: USRobotics, 2010), http://www.usr.com/education/modem3.asp (accessed May 14, 2010).
[180] American National Standards Institute, *ANSI T1.413-1998: Network and Customer Installation Interfaces – Asymmetric Digital Subscriber Line (ADSL) Metallic Interface* (Washington, DC: American National Standards Institute, 1998); CableLabs, *DOCSIS: Specifications* (Louisville, CO: Cable Television Laboratories Inc., 2010), http://www.cablelabs.com/cablemodem/specifications/index.html (accessed May 14, 2010).
[181] National Semiconductor Corporation, *PC16550D Universal Asynchronous Receiver/Transmitter with FIFOs* (Santa Clara, CA: National Semiconductor Corporation, June, 1995), http://www.national.com/ds/PC/PC16550D.pdf (accessed June 13, 2009).

and 16450 UARTs could only control serial connections up to a maximum of approximately 9600 baud. At higher speeds, the controllers attached to the ports modems used would begin to lose characters sent down the line, a consequence of the small buffers they used to hold data prior to transmitting it.[183] 16550 UARTs were backwards-compatible with software written for their predecessors, and the widespread adoption of the technology raised the theoretical speed limit of modem connections to 115,200 baud. This was well beyond the maximum speed that could be sustained using standard analog

"Huma," drawn by Lord Jazz for ACiD's October, 1994 artpack. The face of the figure drawn, a character from a popular series of fantasy novels, was used as the detail image that appears at the beginning of this chapter.[182]

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[182] Lord Jazz, "Huma," in *ACiD: The Acquisition, October, 1994* (Location Unknown: ACiD Productions, October, 1994), http://www.textfiles.com/artscene/acid/ARTPACKS/1994/acdu1094.zip (accessed June 2, 2009).

[183] Frank Durda, "Serial and UART Tutorial," in *FreeBSD Documentation* (Boulder, CO: The FreeBSD Foundation, 1996), http://www.freebsd.org/doc/en/articles/serial-uart/ (accessed June 13, 2009).

telephone service, a fact that made the 16550 an end-of-life technology that was eclipsed by the adoption of the Internet.

Although they were the best available consumer communications technology of their day, modems were never the most efficient means of transmitting data over the telephone network. "Telephone service" really means "voice service," which in turn describes a narrow, acoustic frequency band between zero and four kilohertz suitable for the transmission of conversation.[184] For consumers, public telephone networks were initially designed to deliver audible communications – and nothing else. While the overall frequency band that can be carried by a twisted-pair telephone line is between zero and 1.1 megahertz, a range some 275 times larger than that of the voice channel, analog modems had to make do with translating microcomputer-native digital data into sound waves and sending it up the line as if it was just another species of voice traffic. Great variations in the quality of circuits provided by telephone companies limited speeds to less than the overall carrying capacity of the line, a fact unnoticed by voice users as natural language is less bandwidth-intensive than the sending of data and human beings are better able to detect and correct errors in speech than computers are at correcting errors in a stream of data. Speeds close to the theoretical limit of analog modem technology were reached in 1994, with the International Telecommunication Union's adoption of the V.34 modem standard, and as further improvements required widespread upgrades which would offer only incremental improvements to a moribund analog technology, telecom providers instead focused their efforts on rolling out digital

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[184] Cisco Systems, "Defining Analog Voice," in *Gateway Protocols* (San Francisco, C.A.: Cisco Systems, February 12, 2007), http://www.cisco.com/en/US/tech/tk1077/technologies_tech_note09186a00800a70bf.shtml (accessed June 14, 2009).

subscriber line equipment designed to offer high-speed access to the Internet.[185]

For nearly twenty years, however, the BBS and the analog modem were king, and for between six and ten of those years ANSI artwork prevailed as the predominant form of online artistic expression. It remained so in spite of the fact that modem speeds only increased by a factor of one hundred while RAM, storage capacity and processor speeds exhibited much stronger rates of improvement. This was because even the largest artworks, like Somms' extraordinarily detailed Neo Tokyo piece (see p.119) still clocked in at fewer than forty kilobytes in size. Even though ANSI was a relatively inefficient display protocol, with a ratio of at least three characters sent for every coloured character that was printed on the screen, a 200-line graphic could still be transmitted via telephone in ten seconds or less. In addition, the fact that longer artworks scrolled off the end of the screen meant that the display was always full and never idle: users did not feel the wait time borne of limited transmission speeds as readily as they were constantly entertained, and where the incorporation of extensive artworks in the interface of a BBS produced irritation, users could always abort their display by pressing the spacebar or disable extended menus in favour of the hotkey-driven "Xpert Mode." This feature, which first appeared in Christensen's CBBS, suppressed the display of all interface elements save the prompts at which users would type commands. Custom, quality ANSI art was in some respects an extravagance, one whose principal worth lay in its ability to signal the status of a system within the digital underground to its callers. The real reason why users called

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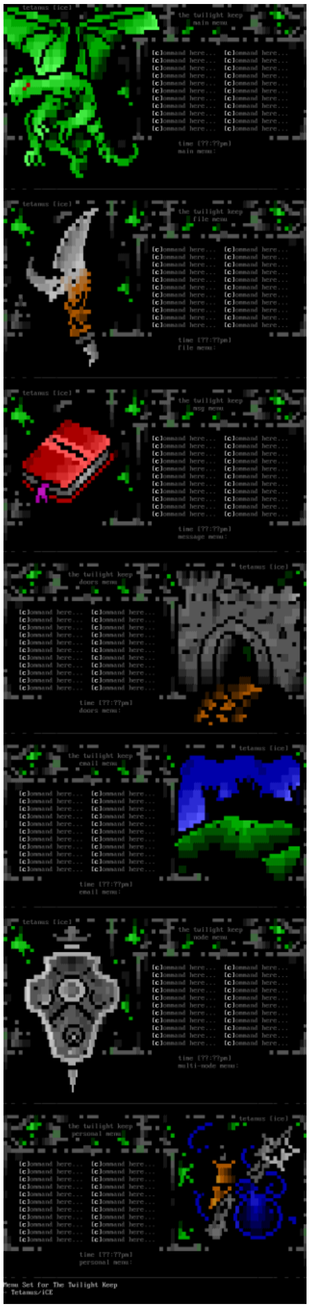
[185] International Telecommunications Union, *V.90: A digital modem and analogue modem pair for use on the Public Switched Telephone Network (PSTN) at data signalling rates of up to 56 000 bit/s downstream and up to 33 600 bit/s upstream* (Geneva: International Telecommunication Union, September, 1998), http://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-V.90-199809-I!!PDF-E&type=items (accessed June 14, 2010); International Telecommunication Union, *V.92: Enhancements to Recommendation V.90* (Geneva: International Telecommunication Union, November, 2000), http://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-V.92-200011-I!!PDF-E&type=items (accessed June 14, 2010).

bulletin boards was not to gawk at the menu graphics, but instead to exchange information with other members of the system. All that they needed to see, from message listings to file descriptors, was sent down the line in rapidly-transmitted bare text. This permitted the medium to retain its viability in spite of the slow pace of improvements in modem speed and the hard upper limit against which the technology pressed by the late 1990s.



Fantasy-themed BBS menu art for "The Twilight Keep," drawn by Tetanus for ICE's March, 1997 artapack. Each individual is 25 lines or fewer. [186]

Sought Goods and the Speed of Data

Where the limitations of analog modems and the BBS were most keenly felt was not in the speed of their interface, which was always adequate, but instead their ability to efficiently distribute binary files and serve multiple users. Here two problems of scale presented themselves. First, since linear increases in the speed of modems were outstripped by exponential improvements in platform capability and application size, modems gradually became the major bottleneck in the networked dissemination of software. They worked well when the average application was smaller than, say, ten megabytes in size, as that much data could be transmitted over a fast modem connection in two hours or less. Once new applications

[186] Tetanus, "The Twilight Keep Menu Set," in *iCE Productions March, 1997 iCEPack* (Location Unknown: iCE Productions, March, 1997), http://www.textfiles.com/artscene/ice/icepacks/1997/ice9703a.zip (accessed June 6, 2009).

which took advantage of the improved multimedia capabilities of microcomputer systems became the norm, games foremost amongst them, transferring these programs over the analog telephone network became time-prohibitive. The primacy of the floppy disk was successfully challenged by the CD-ROM for the same reasons, specifically that application size had outstripped the data density of the medium. As one of the major engines of the underground BBS scene and the artwork it encouraged was the distribution of pirated software, these problems of scale encouraged the replacement of this paradigm of online interaction by others that were more suitable – like the use of high-speed Internet connections. Fully digital subscriber solutions could deliver data at speeds much faster than their analog counterparts, making downloading a large application a task that took minutes instead of hours. These transfers could also take place as background processes running under modern, graphical, multi-tasking operating systems rather than foreground tasks which required one to devote all of the processing power of a computer to transferring files from a remote system. Users were free to initiate a download and then continue using their computers, a fact that was encouraged by the inherent robustness of the Internet Protocols (TCP/IP) when compared to their relatively fragile serial line equivalents.

Second, telephone-based systems could not serve multiple users without cost-prohibitive capital investment. As BBSes were circuit-driven affairs, adapting them to accommodate multiple simultaneous callers required the purchasing of new modems and the leasing of additional lines from the telephone company. Only one user could access a bulletin board via one telephone line at one time, so attempting to offer service to even as few as four simultaneous users quickly pushed the costs associated with running such a system out of the reach of most private operators. By contrast, a link to the Internet is connection-driven: it is a pipe that can be filled with as many discrete, independent streams of data as its bandwidth can accommodate, and it provides this link through a single interface installed at the customer end-point instead of multiple telephone lines. The constraints that govern the ability to serve multiple simultaneous users therefore reside in the total amount of available bandwidth on the one hand and how much system memory and processor time is required to accommodate each individual connection on the other. It also sidesteps the quasi-geographical audience limits imposed by the tariff innovation of area codes, allowing the operators of Internet-connected hosts to address a much larger base of potential users at lower cost than could be accomplished via the public telephone network.

"Plateau," drawn by MoleQL for Root Productions' May, 1997 artpack. This was the author's BBS, which operated out of Ottawa between 1994 and 1999.[187]

The vitality of ANSI as an art form thus depended on the continued vitality of the technological substrate that encouraged its emergence in the first place. Although it was design quirks inherent in the IBM PC that drove ANSI to take the form that it did, the continued backwards compatibility of that platform demonstrates

[187] MoleQL, "Plateau," in *Root Productions, May 1997* (Ottawa: Root Productions, May, 1997), http://sixteencolors.net/packs/1997/root0597.zip (accessed June 7, 2009).

that it was not a change in a platform-level constraint that caused the decline of the form. What killed ANSI was instead a paradigm shift akin to that which spawned the microprocessor revolution, namely the commoditization of network access and the replacement of narrowband telephone company network connections with broadband links to the Internet. The removal of software piracy to the Internet meant that the BBS lost its status as the broker of privileged information; with that, ANSI lost its currency as a signifier of elite status within the pirate community. But to complete the history of the rise and fall of the form, we must now turn to the social – the values of the dial-up digital underground that encouraged this mode of expression.

IV

Flow, Ebb and Die: Electronic Ethos and the Expressive Impulse

> And then it happened... a door opened to a world... rushing through the phone line like heroin through an addict's veins, an electronic pulse is sent out, a refuge from the day-to-day incompetencies is sought... a board is found.
>
> "This is it... this is where I belong..."
>
> I know everyone here... even if I've never met them, never talked to them, may never hear from them again... I know you all...
>
> This is our world now... the world of the electron and the switch, the beauty of the baud.
> -- "The Mentor," *The Conscience of a Hacker*[188]

The explanation of the development of ANSI artwork advanced thus far has fixated on the role of technology in defining the rise of the form and its limits. While objective factors like screen resolutions, colour palettes, modem speeds and network accessibility act as parameters that define the digital expression on a given platform, they fail to expose the operation of amorphous, subjective social forces that explain why artists choose to create artworks in the first place. As demonstrated by the origins of the microcomputer industry itself, the commoditization of integrated circuits and microprocessors merely created an environment in which the development of the personal computer was "possible" in that it was economically feasible. What drove private individuals to integrate existing technology into the form of the microcomputer

[188] The Mentor, "The Conscience of a Hacker," in *Phrack Magazine* 1, issue 7, "phile" 3 (January 8, 1986), http://www.phrack.org/issues.html?issue=7&id=3&mode=txt (accessed May 9, 2010).

was either the valorization of technical ability and the primacy of the pursuit of knowledge in the ethos of hobbyist communities, where the development of elegant solutions provided both individual satisfaction and group approbation, or the desire to profit by selling said technical solutions to the same group. Much as a history of Italian Renaissance painting would need to explain the nature of the form in terms of pigment and paintbrush as well as patronage and politics, a history of ANSI artwork cannot proceed without examining the values of those who created and viewed the works.

This chapter will fill this gap by exploring the ethos that encouraged the creation of ANSI art. Earlier sections exposed the ways in which the regulation of group behaviour was affected by the decline of geographically-bounded sites of computer-user interaction and their replacement by anonymous, networked forms of interaction like the BBS. The most obvious example of this was the software piracy BBSes encouraged through their capacity to act as anonymous brokers of sought goods to a larger audience than had existed previously. As discrete communities, however, they also developed novel values that were expressed through the combination of software and art that was their user interface. Inter-group rivalry and the competition for individual and group status within the computer underground took the form of software-backed restrictions designed to separate privileged users who had access to sought goods from the broader BBS user base. These reinforced hierarchies of power constructed along lines of reputation and access that were uniquely referable to the technological environment in which these systems operated. Taking as their own a peculiar definition of eliteness through an equally peculiar definition of excellence, artists and systems operators used a combination of visual representation, restrictions on access and the repetition of tropes to promote their own values and define status according to the successful internalization and display of the same. All of this took place against the performative backdrop of the handle, the chosen name through which the self was projected into the net.[189]

Growing Up Elite: Status and the Underground

The animating social force of the digital underground was "eliteness." Not "elite status" or "elite membership," grammatically-correct turns of phrase, but instead *eliteness*, a term of art specific to the milieu. Elites have existed throughout history as groups that possessed some combination of power, privilege, skill, wealth, political access, military prowess or religious aptitude, but the defining characteristics of an elite are recognition of the group as such and its status as brokers of some sought good. They aggrandize themselves through their ability to trade access for fealty and formal or informal favours, thereby reinforcing the vertical hierarchies and horizontal ties of association that sustain them. As the scheme of social organization within which they operate increases in complexity, so too does the diversity of such groups, their degree of specialization, and the complexity of the membership-defining values they internalize. Status and belonging are signalled to those inside and out by the repetition of ritual and through acts of social performance that demonstrate commitment to group ideals.[190]

This chapter opened with a quote from *The Conscience of a Hacker* by The Mentor, a brief work he wrote for the *Phrack* e-zine shortly after his 1986 arrest for various computer-related crimes. In it, he speaks eloquently of the strong sense of

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[189] Sherry Turkle, *The Second Self: Computers and the Human Spirit* (Cambridge, MA: The MIT Press, 2005).
[190] Robert D. Putnam, *The Comparative Study of Political Elites* (Englewood Cliffs, NJ: Prentice-Hall, 1976); Mattei Dogan *Elite Configurations at the Apex of Power* (Leiden: Brill, 2003); T. B. Bottomore, *Elites and Society* (Hammondsworth, U.K.: Penguin, 1964).

belonging he felt when interacting with other users in his digital community, that of hackers who frequented the bulletin board systems of the mid-1980s. In a section not quoted above, he contrasts the prejudices and banal, day-to-day barbarities of the real world with those of the BBS, in which users "exist without skin color, without nationality, [and] without religious bias," seeking only knowledge, acting only on curiosity, and rewarding only proficiency. At first blush, it is a work of some idealism: it casts the intermediary of the microcomputer as a filter that strips out all but ability and intellect, allowing users to "judg[e] people by what they say and think, not what they look like." This is a laudable and idealistic conceptualization of one of the unique features of digital interaction. But is it accurate?

User and System Hierarchies in the Software Piracy Scene

Users	Systems
Suppliers	(n/a)
Release Groups	Affiliated BBSes ("member boards")
Couriers	0-Day BBSes ("distro sites")
Elite Users	0-7 Day BBSes
"Leechers"	Generic Pirate BBSes
"Lamers"	(no access)

The answer must be no, for while BBS users were prevented from acting on more mundane prejudices by virtue of the anonymization inherent in computer-based interaction, they proved remarkably adept at erecting their own parallel hierarchies scarcely different from those found in real life. To take software piracy as one example, warez suppliers were more elite than the groups that packaged their offerings and distributed them to top-tier systems, top-tier systems operators were more elite than their users, these users were more elite than the mid- and bottom-tier systems that were responsible for the bulk of computer piracy, and users of these last systems were more elite than the "lamers" who bought software legitimately or ran shareware bulletin board systems. Elaborate access-filtering mechanisms, be they file-transfer ratios, file point credit systems, post-to-call-ratios, new user passwords and new user voting mechanisms were designed to separate those who had access to sought goods from those who did not. In the hacking scene, a bifurcation developed between those who could devise their own security-circumventing exploits and, to use a retrospective term, the "script kiddies," "crashers" and simple criminals who used the information gained by "real" hackers to commit acts of vandalism or crimes of profit instead of crimes of curiosity and knowledge.[191] Systems and users were divided between those that had "affilz," either because they were members of underground groups or operated systems that acted as digital hangouts or "distro" (distribution) sites for warez, hacking tools, artpacks and the like, and those that did not. While users like The Mentor propounded the myth that they loved the BBS because it liberated them from the prejudice they experienced as computer geeks, a more plausible explanation is that they loved the BBS because it represented a realm in which they could wield the same kind of exclusionary power they complained of elsewhere.

One way in which the BBS scene was somewhat unique, however, lay in the fact that those that participated in it did not do so to accrue power or acquire goods that could be readily translated into real-world gains beyond getting free software or free long distance communications. The centrality of status in this can be determined by examining the economy of ware-trading, where the reputation built around a given user's handle provided the trust required to barter for illicit goods or enhanced access. Dedicated warez packagers and couriers, operating as they did under the same constraints

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[191] Noel, "Feature: The Danger of Script Kiddies," in *RootPrompt.org* (Crawfordville, FL: Rootprompt.org, August 7, 2000), http://rootprompt.org/article.php3?article=756 (accessed May 19, 2010); Honeynet Project, "Know Your Enemy: The Tools and Methodologies of the Script Kiddie," in *The Honeynet Project* (Naperville, IL: The HoneyNet Project, July 21, 2000); http://old.honeynet.org/papers/enemy/ (accessed May 19, 2010); Andy McCue, "Hackers Expose Script-Kiddie Underground," in *ZDNet* (New York: Ziff Communications Company, October 27, 2003), http://www.zdnet.com/news/hackers-expose-script-kiddie-underground/132417 (accessed May 19, 2010).

of speed and scale as all other users of the telephone network, rarely had time to play the games they were trading; dedicated sysops of pirate BBSes, given that they had to devote all of at least one computer's processing time to running the system, rarely did more than operate the clearing-houses of the illicit software industry.[192] Adjusted for protocol overhead and the standard problems that plagued telephone lines, a ten megabyte game took nearly two hours to transfer at the 1990s-standard speed of 14,400 baud. By the time CD-ROMs came into vogue in the mid-1990s, release sizes grew to be a hundred megabytes or more and required most of a day to download. With between four and six hours of free time available at the end of a standard eight-hour work day, the notion that the heavy lifters of the pirate scene actually used the goods they were transferring becomes implausible in light of the technological environment they were operating in. This much was confirmed by TC, author of the eighth edition of the so-called "Pirate's Manifesto," within the context of the increasing number of releases that contained viruses:

> [T]rue world class file spreaders do not have time to sit and check out every file they just downloaded off these major elite sites. World class spreaders grab the files and run them as fast as they can move em. It is only after some poor dolt sits and actually runs the damn thing that it is found out that it destroys hard drives. Than [sic] the poor courier has to run like crazy to have the file nuked off the sites he sent it to - or else his reputation goes down the toilet. . . Like all good elites I select the boards I do business with based on the confidence that the board I am uploading to will be in existence for many years into the future.[193]

Users of underground BBSes had different interests and different primary motivations, from the seeking of warez to the discovery of new programming or hacking

[192] Jim Thomas and Gordon Meyer, *Software Piracy: An Alternate View* (Location Unknown: March 5, 1990), http://www.textfiles.com/piracy/piracy (accessed May 19, 2010).
[193] TC, *Pirate's Manifesto VIII* (Location Unknown: July 20, 1994), http://www.textfiles.com/piracy/manifest.-7 (accessed May 19, 2010).

techniques to the creation of art. Beyond the amusement of their chosen activity, however, the forces that drove participation were reputation, status, and inter-group competition. Writing his retirement letter in the wake of widespread busts of pirate BBSes by U.S. law enforcement in 1992, The Renegade Chemist of Razor 1911 spoke of his time in the scene and his evolution within it when he said "Sure, I have enjoyed it, starting up from a lamer with the handle 'Fletch Lives,' moving up towards a higher status in ModemLand. A lot of people have helped me / hurt me on the way up, but all in all I appreciate all of the criticisms, constructive and destructive."[194] London author David McCandless identified the craving for status and the addiction of collecting illegal software in a 1995 article in which he detailed the exploits of The Inner Circle, then an elite warez group:

> Warez crackers, traders, and collectors don't pirate software to make a living: they pirate software because they can. The more the manufacturers harden a product, with tricky serial numbers and anticopy systems, the more fun it becomes to break. Theft? No: it's a game, a pissing contest; a bunch of dicks and a ruler. It's a hobby, an act of bloodless terrorism. It's "Fuck you, Microsoft." It's about having something the other guy doesn't. It's about telling him that you have something he doesn't and forcing him to trade something he has for something you don't . . . for Joe Warez Addict at the end of the cracked software food chain, membership in a group like the Inner Circle is the ultimate collectible.[195]

Here one sees the unification of the hacker ethos of early microcomputer hobbyists, which prized technical prowess above all else, with the unique performative environment

[194] The Renegade Chemist, *To My Friends in the Scene, and Those I Don't Even Know* (Location Unknown: 1992), http://www.textfiles.com/piracy/flame06.txt (accessed May 19, 2010); Static, *Being Busted* (Location Unknown: January 31, 1992), http://www.textfiles.com/piracy/morebust.nfo (accessed May 19, 2010).
[195] David McCandless, "Warez Wars," in *Wired* 5.04 (New York: Condé Nast, April, 1997); http://www.wired.com/wired/archive/5.04/ff_warez_pr.html (accessed May 19, 2010).

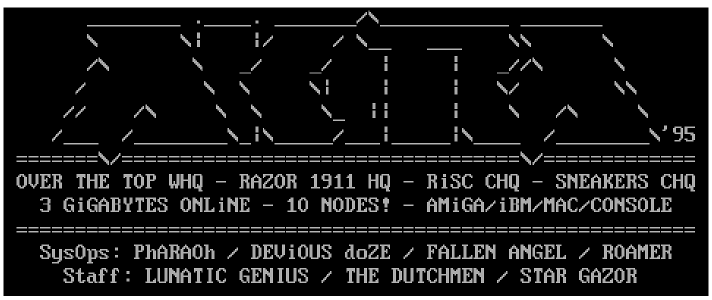
of the underground BBS scene.[196] Cracking copy-protection algorithms represented a unique software challenge, but one that meant little absent the approbation provided by an audience of users. It was not enough to merely circumvent application copying restrictions; what was desired instead was the recognition of status and the ability to translate this into more favourable access on coveted systems.

These boards craved the best releases and the best pirate group affiliations, the kind that produced a consistent stream of elite "0-day" warez. The number in the term refers to the lag time between the official release date of a given piece of software and when it would appear on pirate boards. Top systems acted as the world or regional headquarters (WHQ / USHQ / CAHQ) of warez groups, hosted 0-day, 0-3 day or 0-7 day releases, and zealously excluded users who either lacked new warez to trade or failed to keep their upload/download ratios in check. As decreases in the cost of physical storage space during the 1980s and 1990s were matched by the increasing size of commercial software applications, busy 0-day systems rarely had more than a few weeks' worth of pirated software on hand. There were simply too many releases being uploaded to permit the long-term storage of files received, and of course actually using them was hardly the point. In a review of a BBS called "Beyond Akira," run out of Toronto's 905 area code in the mid-1990s, The Renegade Chemist describes the technical limitations faced by top systems during this period, their remarkable size (10 phone lines!) and the pressures of the scene:

> For files this system is number 1 in Canada, no question. Internationally, Beyond Akira is a rising contender. The board has a marginal number of

[196] The same phenomena popped up repeatedly in each branch of the subcultures of the digital underground. In 1997, *Wired* published an article that touched upon the same within the context of, believe it or not, the Bulgarian virus scene: David S. Bennahum, "Heart of Darkness," in *Wired 5.11* (New York: Condé Nast, November, 1997), http://www.wired.com/wired/archive/5.11/heartof_pr.html (accessed May 19, 2010).

> locals, along with a growing number of LD [long distance] traders . . . [It] is strictly a file oriented board, concerned with files by the hour. The IBM conference is filled with the arrogant gloating of various traders, along with the odd remark from pay users. For the longest time, an extremely sacred new user password has prevented Akira from being flooding with applications . . . Few 28.8 Nodes (only 3) make it difficult to get a good speed. The userlist on Akira is so numerous, the board is constantly busy even with 10 node ringdown. This poses a severe problem for LD callers. With a Gig a week uploaded, its [sic] very difficult for the board to keep older files online (Only 3 gigs online space). Sure, there is a 640meg CD rom [sic] online, however that generally only has a few utilites [sic] from the previous month. Overall, Akira is an excellent system for the fastest files around, none-the-less the system is in desperate need of more hardware. A quick observation [sic] the board has more sysops, that [sic] it does nodes and needs some organization and direction. Hopefully, the board will continue to dominate and stay afloat for a long time to come.[197]



ASCII art "NFO" (info) file for a release downloaded from Akira in 1995, probably the same time The Renegade Chemist's review was written. Note the prominence given to the BBS' group affiliations, the recitation of hardware and connectivity statistics, and the use of "elite" capitalization in the text – regular letters are written in capitals while I and O appear in lowercase.[198]

The values of the pirate BBS scene present a difficult target for historical reconstruction through primary sources for two interrelated reasons, one technical and the other social. First, relatively few sources created during the period survived the evolutionary jump to the Internet age, and what sources did survive consisted not of the text contents of the message boards of pirate systems, but instead the NFO (info) files produced by warez groups to document their releases, a small number of short essays and reviews composed by pirates, and the

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[197] The Renegade Chemist, *Beyond Akira* (Location Unknown: The International Network of Crackers, 1995), http://www.textfiles.com/piracy/INC/append (accessed May 20, 2010).
[198] Author Unknown, *Akira NFO File* (Location Unknown: 1995), http://www.textfiles.com/piracy/NFO/akira.nfo (accessed May 20, 2010).

farewell letters written by high-level scene members as they announced their retirement.[199] These capture but a small segment of the overall community, namely the elite of the elite, and represent a very thin slice of the documentary evidence that was available during the ascendancy of the BBS. As participants in *sub rosa* communities, pirates were reluctant to document their activities: membership in the scene was defined by knowledge of its existence and familiarity with its values, not announcing the same to the public at large. Status is what was sought, with status defined more in the minds of other members than the creation of a permanent trace. More importantly, as pirates prized speed and the novel (cf. "Akira is an excellent system for the fastest files around," above), they cared little for either old releases or the maintenance of community history. New warez, new systems, new affilz – these were the things that were sought. In its fixation on chronicling the past, an activity that places itself squarely outside the myopia of the 0-day, history is inherently lame.

The Mask of the Handle

All user activity on underground bulletin board systems took place behind a handle, an alias that acted as the electronic representation of the self. Contemporary forms of online interaction, be they on web-based discussion forums or in the virtual reality simulator known as Second Life, have distinguished the concept of the avatar from that of the handle by their use of images or other graphical representations of the user. These still rely on a handle or username to allow for easy authentication, but they are

[199] This was all too frequently because of law enforcement intervention, though not for pirating software. Instead, what seemed to trap warez traders was the lure of free computer hardware through credit card fraud.

augmented by other media in a way that the BBS handle was not. As with all BBS interactions, a handle was plain text, and the choice of an appropriately elite handle immediately distinguished users who knew the norms of the scene from those that did not. A brief review of the handles used by top-level pirates, the authors of hacker text files, the designers of pirate scene BBS software (the so-called "forum hacks," named for their descent from the apocryphal Forum BBS source code) and top ANSI artists reads like a bizarre melange of references to the concepts found in fantasy novels, heavy metal music and the technical errata of personal computers.

Stone Angel, The Necromancer, Somms, Lord Jazz, Tetanus, Eternal Darkness, Inner Vision, Morbid Angel, Darkforce, Twisted Mind, Future Assassin, Lord Pegasus, Fluorescent Darkness, Epitaph, Mephisto, Nailz, Mister Sinister, Shadow, Stalker, Psyanide, Necros, Darkman, Innate Malice, Spectral Illusion, Midnight Falcon, Slavelord, Exile

The handle: ANSI NFO file from ACiD's July, 1993 artpack. Members are listed according to their role in the organization, either as ANSI or VGA artists, programmers or couriers, as are the names and ranks of officially-affiliated BBSes.[200]

[200] ACiD Productions, "Membership List," in *ACiD: The Acquisition, July, 1993* (Location Unknown: ACiD Productions, July, 1993) , online: http://www.textfiles.com/artscene/acid/ARTPACKS/1993/acdu0793.zip (accessed June 24, 2009).

– the hottest handles drew their inspiration from mythical creatures, comic book characters, death or dread diseases, and the tricks of light and shadow found at twilight. Colour-noun combinations were common, as was the case with Blue Archer or The Gray Mage, and the tendency to use adjective-noun combinations (Final Descendant, Flaming Chaos, Forbidden Image) as well as proper nouns and titles (The Hit Man, Prince of Death, Corwin of Amber) was pronounced. A good handle was designed to intimidate, to convey the message that one was more than a bit player in a mirror world in which traditional morality was inverted and typical assumptions did not hold. As demonstrated by The Renegade Chemist's metamorphosis from "Fletch Lives" to his more elite *nom de plume*, handle choice could define the difference between being taken seriously and being shut out of a system.[201]

A handle was the first building block of an elite reputation, a pivot point around which the separation between real and online life turned. Handles were used everywhere on bulletin boards: they formed part of the headers of public and private messages, were listed after the descriptions of uploaded files, and were continually rebroadcast through the last callers screen commonly displayed just after a user logged in. They graced the "top ten" statistics lists that ranked users according to how many files they had uploaded or how many messages they had posted. They appeared in the information (NFO) files that accompanied warez releases, the artist signatures that appeared in ANSI artworks, and the lists of contributors to artpacks like the example shown above. The digital paper chase of reputation and status that was the cultivation of privilege in the form of recognition and higher-level access to elite systems turned around no greater measure of

[201] The Trash Compactor, *Documentary: The LoserUsers* (Location Unknown: n.d., probably late 1980s), http://www.textfiles.com/humor/lozeuser.hum (accessed May 21, 2010).

trust than the few pithy words that identified an online persona. Maintaining control of this identity by preventing other users from copying one's handle was of vital importance, and would have been impossible had the scope of the network been as large as that of the contemporary Internet. Because bulletin boards operated within the geographic imposition of the area code, however, conflict between users over a given alias was relatively rare.

The centrality of the handle: last callers list from "Termite Terrace," run by Nivenh of iCE out of Garland, Texas in 1995. Information similar to this would have been displayed to every caller just after they logged in to the BBS. Examples of interface templates that actually contain live user data from the period are exceptionally rare, as BBS installation packages were sanitized prior to release and the information used to build the data portion of these screens resided on the thousands of independent systems whose configurations were never archived. This was found in the installation package for the Impulse BBS software, which Nivenh authored.[202]

The fact that users would stake so much on so little, either by engaging in illegal activities or simply devoting hundreds or thousands of hours of effort to the upkeep of an electronic reputation which conferred few identifiable real-life benefits, would be remarkable but for the extent to which the rise of the Internet has made it a common

[202] Mercenary-X, "Last Callers List," in *Impulse BBS Software version 6.5* (Garland, TX: Nivenh [Brandon Sneed], 1995), online: http://www.demonic.net/impulse/files/imp65ful.zip (accessed May 21, 2010).

phenomena, as is the case with online game addiction.[203] In 2010, this makes the expenditure of extraordinary amounts of effort to maintain standing within an anonymous electronic community somewhat mundane, though the numerous underground BBS members whose saw their online activities overwhelm their real-world reputation through their arrest for software piracy, computer hacking, telecoms or credit card fraud testify to the unusual loyalty elite users felt to the milieu in which they could express their alterior identity.

What makes the elite BBS and the piracy and art scenes in which it operated unusual historical phenomena is the fact that they represent the first time in which access to the technology required to engage in anonymous online interaction was widespread enough to place these systems and their users within the domain of mass culture. Regardless of the fact that personal computer ownership remained rare until at least the mid-1990s and only a small percentage of users in the period prior to that participated in either online software piracy or could claim membership in the groups that sustained it, the only reason why this was possible was because of the commoditization of computing technology and access to the public switched telephone network. Once both were removed from the closed, geographically-bounded communities that had governed computer access up until the economic paradigm shift that was the microprocessor, it was nigh on inevitable that the standard mechanisms of social control that had inhibited illegal or *sub rosa* activities amongst mainframe users would also be bypassed. Without the masking effect of the handle and the dial tone, filters that effectively paralyzed physical social surveillance, none of this would have been possible.

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[203] Steve Mollman, "For Online Addicts, Relationships Float Between Real, Virtual Worlds," in *CNN.com* (Atlanta, GA: Cable News Network, January 29, 2008), http://edition.cnn.com/2008/BUSINESS/01/29/digital.addiction/index.html (accessed May 20, 2010).

If the motivation that underlay such superficially quixotic acts as spending hours drawing ANSI artwork, trading software releases or attempting to gain access to all-but-closed systems still seems inscrutable, one must only look back at the subtext of The Mentor's 1986 manifesto to explain the expenditure of effort. Why subsist with being John Q. Public, an individual as unremarkable as any other, when with but a flip of a switch and the audible whine that accompanied a successful modem connection one could become "Neon Samurai" or "Crime Lord" or the all-too-appropriate "Alter Ego," an electronic persona whose name was known, presence in the ebb of data was felt, and favour was sought?[204] Standing in the scene – if one was "in," that is – provided some species of power over others, and if one thing is certain it is that the aspartame version of self-actualization that relies upon the exclusion of others does not demand that its wielders possess the power of kings. It is enough to be someone to somebody, no matter how trivial or ephemeral that link may be. In their typical devotion to some kind of illegal activity, even if it was as minimal as copyright infringement, underground BBSes nurtured a sense of belonging made only stronger by their self-proclaimed defiance of what their membership held to be traditional morality.

In this it bears remembering that BBS users were predominantly white and male, and that warez traders, ANSI artists and hackers were typically young and unattached.[205] While it is impossible to reconstruct the profile of the typical user because of anonymity

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[204] ACiD Productions, "Membership List," in *ACiD: The Acquisition, June, 1994* (Location Unknown: ACiD Productions, June, 1994), http://www.textfiles.com/artscene/acid/ARTPACKS/1994/acdu0694.zip (accessed June 24, 2009).

[205] Marc Rogers, "The Psychology of Hackers: Steps Towards a New Taxonomy (Lecture Notes)" in *Psychology and Computer Crime* (West Lafayette, IN: Center for Education and Resarch in Information Assurance and Security, Purdue University, May 28, 1995), http://homes.cerias.purdue.edu/~mkr/Taxonomy2.ppt (accessed May 21, 2010); Bernadette Schell and Thomas J. Holt, "A Profile of the Demographics, Psychological Predispositions, and Social/Behavioural Patterns of Computer Hacker Insiders and Outsiders," in *Online Consumer Protection: Theories of Human Relativism* (Hershey, PA: Information Science Reference, 2009).

on one hand and the paucity of sources on the other, circumstantial and anecdotal evidence strongly supports this conclusion. The handles used, the style of writing in NFO files, the typical subjects of ANSI artwork (buxom comic book women were not unusual, nor were naked anime figures), the fact that the authors of BBS software were universally male and the time requirements of maintaining a presence in the scene all point in the direction of nearly exclusively male membership. The BBS run by this author counted perhaps one female user for every hundred male users, and the insensitivity to risk and tendency towards egoistic contests of one-upmanship within the scene itself point to the kind of demographic conclusions that have traditionally caused automobile insurance underwriters to increase the premiums paid by males under the age of 24. So too does the spirit of rebelliousness and defiance of authority that was part of the public persona of the erstwhile hacker or warez trader, best encapsulated in five of Dixie Flatline's "9 Reasons Why _You_ Should Be Humping Warez, namely "f*ck the software companies!," and the fact that the few surviving descriptions of the elite warez scene written by users consistently take the universal male when describing pirates.[206]

New User Passwords, Infoforms, and New User Voting: Keeping the Lamers Out

The scalability of bulletin boards was constrained by two major technological factors: processor power and their use of telephone lines as their sole means of communication. Up until the mid-1990s and the development of fast microprocessors

[206] The Dixie Flatline, *You Hack Em We Hump Em, or Why YOU Should be a Software Courier* (Location Unknown: n.d., probably early 1990s), http://www.textfiles.com/piracy/courier.txt (accessed May 21, 2010); Beowulf, *Beowulf's Thoughts on the CD-Ripping Scene* (Location Unknown: n.d., probably mid-1990s), http://www.textfiles.com/piracy/flame02.txt (accessed May 22, 2010); Author Unknown, *The Anatomy of a Pirate* (Location Unknown: n.d., probably early 1990s), http://www.textfiles.com/piracy/anatomy.txt (accessed May 21, 2010); Cool Hand, *(Unnamed) – Flame to Other Pirate Group Members* (Location Unknown: n.d., probably prior to 1993), http://www.textfiles.com/piracy/flame08.txt (accessed May 21, 2010).

and modern multitasking operating systems, CPU speed limited the number of nodes (users, or in other words lines waiting for calls) to one per computer system. This meant that running a BBS demanded a significant investment in the form of a personal computer dedicated to serving callers, with all but the most specialized commercial bulletin board software allowing a single computer to handle a maximum of four simultaneous users.[207] Typical BBSes maintained a one-to-one computer-to-node ratio to ensure that the system was responsive enough to be useable. To this was added the circuit-driven constraint of the telephone network, namely that only one user could use a node's telephone line at a time.

BBS software confronted these problems by implementing per-user limits on how much time could be spent on the system during a given day. Standard allotments were of one hour or less, though various packages supported the option of banking unused time for future consumption. Allowed time online was independent of the speed at which the user connected to the system, so if one dialled up at 2400 baud instead of 14,400 or faster one could expect to get less use out of the system in a given day. File transfer times were calculated before initiating a download; if a user placed more files in their transfer batch than their remaining time allowed they would be prevented from initiating the transfer.

System software allowed for the configuration of variable user access levels that governed both the amount of time users could spend online as well as what file bases and message areas they could access. Privileged users on a given BBS, be they co-sysops, file and message moderators, long-distance callers, or members of elite scene groups

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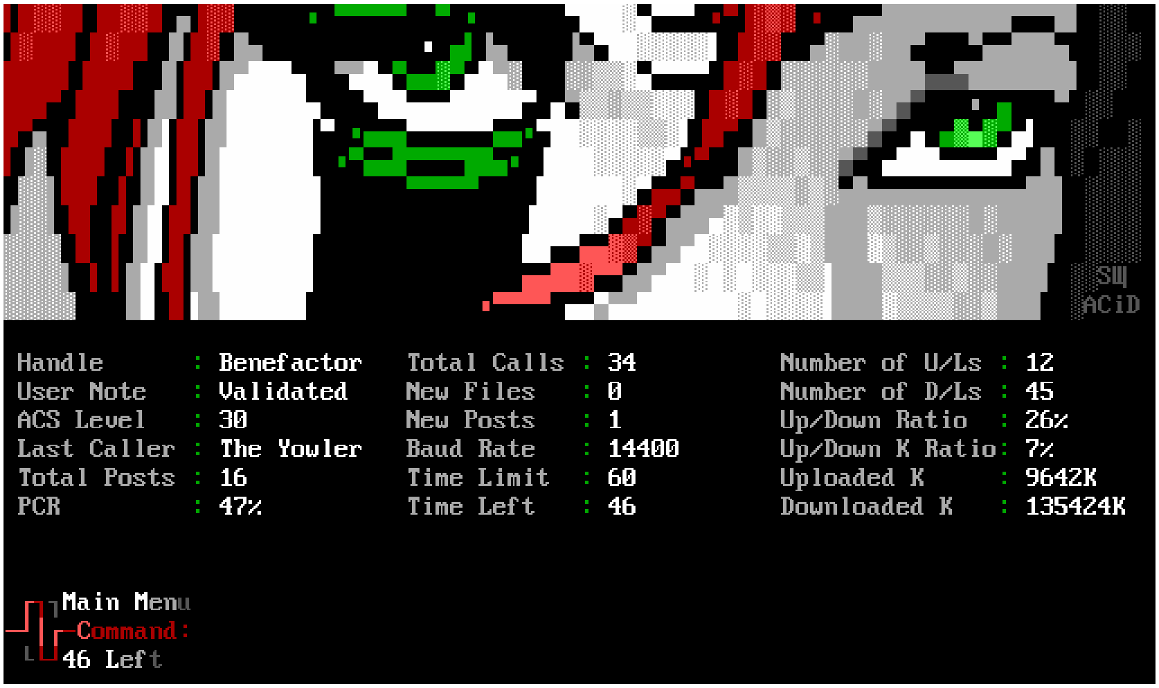
[207] Typically through the use of DESQView, Quarterdeck's semi-revolutionary DOS multitasking software. Andrew Langmead, ed., *DESQView / QEMM Frequently Asked Questions* (Location Unknown: November 2, 1995), http://www.uni-giessen.de/faq/archiv/desqview-faq/msg00000.html (accessed May 21, 2010).



Art, interface and user control combined: output from "Your Stats" function of the Oblivion/2 BBS package (version 2.30, released 1995), with main menu prompt included. The ANSI appears to have been drawn by Somms of ACiD some time between 1993 and 1995. The user data that appears in this image is not from that period, but has instead been injected into the BBS data files before being outputted by the software to show how this screen would have appeared to the user.[208]

might be given more generous access based on their contributions to the system, their affiliation with a warez or ANSI group, or merely by virtue of their reputation. It was not unheard of for public domain systems to house a hidden, secret, possibly password-protected transfer area loaded with pirated software for users who formed part of a system's inner circle. One never knew just what a system held until the system operator validated a user account to a higher level of access, and since sysops could turn on the local console and watch a connected user interact with the BBS on a keystroke-by-keystroke basis, upgrading or downgrading access on the fly and breaking into line-by-line chat as needed, it was possible to maintain tight, immediate control over the use of the system.

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[208] Somms, "Your Stats ANSI Stats Screen," in *Oblivion/2 BBS Software version 2.30* (Location Unknown: Darkflame Enterprises, 1995), ftp://ftp.scene.org/pub/mirrors/artpacks/www/mirrors/acidic/obv2/obv2-230.zip (accessed March 15, 2009).

These broad restrictions on access simply governed the overall use of resources rather than enforcing standards of user behaviour. This last was the responsibility of ratios in various forms, be they file transfer ratios, download credit systems, or post-to-call ratios. A file ratio system made sure that users contributed their own files to the BBS by enforcing limits on how much they could download. A staple of warez BBSes, where demand for pirated software often outstripped supply, ratios permitted users to pull files off the BBS only in proportion to what they had uploaded themselves. Download credit systems worked in much the same way, with one file point typically being consumed for every ten kilobytes of hosted files the user downloaded, but credit systems permitted more finely-grained control than ratios. As an example, file credits could be awarded as a ratio of the amount uploaded, allowing for rewards like two-to-one credit for files uploaded. Sysops could also award arbitrary amounts of credits for good uploads or set the cost to transfer a particularly desired or valuable release higher based on demand. All of this was designed to prevent "leeching," the transfer of files without contributing anything in return. User Caramon Majere pointed to the advantages of these emerging methods of controlling user behaviour when, in 1989, he wrote a text file that described how to hack the Telegard BBS software:

> Hey, look, Telegard, great BBS software, everyone loves it, and it even has three ways to prevent leeching, one, Upload/Download ratio, Percentage ratio, and File points. Well, I don't know how to avoid any of those, just don't be a leech. But, you do want to get into that semi-private SysOp stuff, right? This file will teach you how, and you won't get caught, well, unless the sysop watches you. . .[209]

Warez bulletin boards could control user behaviour relatively easily, as the

[209] Caramon Majere, *How to Hack Into a Telegard Board* (Location Unknown: n.d., probably 1992 or earlier), http://www.artofhacking.com/tucops/hack/bbs/live/aoh_hacktlgd.htm (accessed May 24, 2010).

transfer of files provides an objective, definable metric by which user contribution can be measured. Systems devoted to hacking, phone system exploration/fraud, virus authoring and the like were policed with some difficulty as what they traded in was information instead of the latest file releases. The quality of this class of systems was defined by the level of activity on their message boards and the knowledge possessed by their users, with community taking the form of publicly posted messages where the latest tips, tricks and discoveries were exchanged. The post-to-call ratio (PCR), which forced users to write a certain number of public messages in proportion to how often they called the system, represented an adaptation of file transfer ratios to the written word. It was much cruder than its forebears because sysops validated file uploads before permitting other users to download them, thus ensuring they were vetted for quality prior to release. No systems held messages for moderation before allowing other users to read them, as to do so would have represented a time-consuming bottleneck as well as a violation of the commitment to free speech that was part of the BBS ethos.[210]

While the PCR was thus a fixture of BBS software commonly in use in the digital underground, it was rarely used. Instead, sysops relied on their own judgment of who was contributing and who was not through their own interaction with the system. Users who failed to live up to expectations, be they through constant leeching or failing to post enough messages, would find their accounts locked out or deleted and their handles added to a lockout list that prevented their being used again during the signup procedure. Particularly bad users, whether inveterate leechers, reputed "feds," those that attempted to hack the BBS or those that committed any other cardinal BBS sin quickly found

[210] For a discussion of ratios, including post-to-call ratios, see Bubba, ed., "What Does A Sysop Want In A User?" in *IceNET News* (Location Unknown; likely Western New York: IceNET, September, 1992), http://www.textfiles.com/bbs/ICENEWS/news9209.txt (accessed May 24, 2010).

"Blacklist" screen from Killean's NUVote program for the Renegade BBS software, released in 1994. After logging in, undesirable users would receive this or a similar message before being automatically disconnected from the BBS.[211]

themselves digitally run out of town. Sysops communicated with each other through the mail networks their systems participated in or simply by calling each other's boards, and bad users could easily find themselves barred from a number of elite systems in a given area code for a transgression committed on one. Although they competed against each other for callers, with nothing advertising a top system better than users constantly receiving a busy signal when they attempted to reach it, sysops were more loyal to each other than to their users. After all, the very fact that they were sysops meant that they controlled access to something that the callers wanted. This placed them in a separate, more elite caste than those who were simple clients of the system.

The preceding merely describes the artifices used to control user behaviour once

[211] Killean, "Blacklist ANSI," in *NUVote version 3.1* (Location Unknown: BeerWares Utils, 1994), ftp://archives.thebbs.org/renegade_utils/nuvote31.zip (accessed March 15, 2009).

they had been granted access to a bulletin board. Of greater utility in describing the ethos of eliteness and the exclusivity this implied are the signup procedures users were forced to follow before gaining access to the inner sanctum of a system in the first place. Access to scene bulletin boards was restricted by four major mechanisms: the publication of the

Arrow-key style "matrix" shuttle logon menu designed for use with the Renegade BBS software by an unknown author in 1994. Elite systems frequently used arrow-key menu systems to overcome the typical line-by-line output of BBSes, providing the appearance that the caller was using a program rather than dialling in to a system.[212]

telephone number of the board, the use of new user passwords, mandatory new user questionnaires known as "infoforms," and software subroutines that allowed established users to vote on whether to grant full access to new prospects. These were all optional measures. Sysops might choose to use any combination of the above or none depending on what message they wanted to convey to new users, their political inclination (more anarchist sysops imposed as few restrictions as possible), the degree of illegal activity their system condoned and their fear of interception, the extent to which they felt they were being overwhelmed by applications from lame users and other factors, but as these

[212] Carlos Legaretta, *Matrix Lightbar Shuttle for Renegade BBS* (Location Unknown: 1994), ftp://archives.thebbs.org/renegade_utils/lightbar.zip (accessed March 15, 2009).

features were found across all species of scene-oriented BBS software they demonstrate that access controls were routinely imposed. Leaving aside the fact that at least in Canada it was remarkably difficult to attract the interest of law enforcement without either charging for access to warez or engaging in fraud, hacker and warez BBS operators constantly feared that they were being watched by the authorities and sought to avoid exposing knowledge of their systems to the broader public.[213] Besides, how could one build an elite reputation by running a system that everyone knew about and anyone could access?

Users of public domain bulletin boards expected and received quick access through call-back verifiers (CBVs), programs that rang a user back on the phone number associated with their account to prove their identity. Duplicate accounts were thus weeded out on the basis of the phone numbers on record, and while it was trivially easy for knowledgeable users to trick CBVs by picking up another extension just as the system hung up and then playing a recorded dial tone into the receiver, use of this technique was relatively rare. On elite systems, getting full access could take days: shuttle logon programs, which provided access to a limited subset of BBS functionality without having to fully log in, typically contained both "apply" and "check" functions, the latter provided to new applicants to allow them to determine whether their access had been upgraded without having to log on.

[213] Leaving aside the fact that the section 42(c) of the *Copyright Act* (R.S. 1985, c. C-42) creates a dual summary conviction / indictable offence for "distributing infringing copies of a work . . . to such an extent as to prejudicially affect the owner of the copyright," Canadian police proved substantially less eager than their American counterparts to kick in doors on behalf of the software industry. Hacker BBS operators had it even easier: so long as they restricted themselves to the mere discussion of security-circumventing techniques rather than suggesting or participating in the commission of specific illegal acts, they would not fall afoul of either the conspiracy or counselling sections of the *Criminal Code*. See *R. v. Hamilton* (2002), 309 A.R. 305, 3 Alta. L.R. (4th) 147 (A.C.Q.B.), a case from the Internet era that illustrates the point nonetheless.

Prior to even applying to a system, however, a user had to find out its telephone number. While many ANSI BBS advertisements and release NFO files provided phone numbers, others listed only system and sysop names and partial area codes that either obscured the number or mocked the user: 416-YOU-WISH, 613-2FA-ST4U or xxx-ITS-BUSY were typical formulations. Separate, system-specific NFO files were also injected into uploaded archives to provide an advertisement for the boards the file had transited through before being downloaded by a particular user. This acted as a trace of the digital underground, with sought-after files on low-level systems often containing several advertisements attesting to the origins and path of the file. These also appeared in the text-only comments displayed by archiving software when uncompressing a file, with users receiving unsolicited BBS endorsements on screen whenever they unpacked a ZIP.

Monochrome ANSI NFO file for "The Empire City," date and author unknown, which was injected into all archives uploaded to the system. Note the reference to 0-day files, the fact that the phone number is obscured, and the bragging tagline at the end.[214]

Operators of elite systems wanted their boards to be known, even well-known, but

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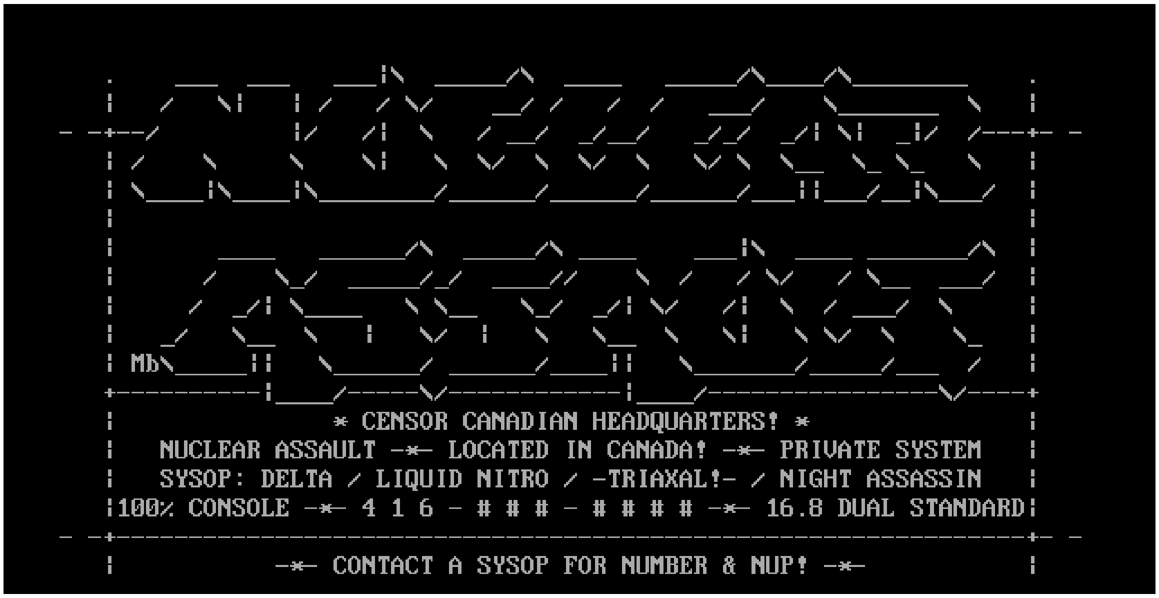
[214] Author Unknown, *The Empire City ANSI NFO File* (Location Unknown: n.d., probably early 1990s), http://www.textfiles.com/bbs/ADS/read-me.nfo (accessed March 15, 2009).

not necessarily easy to find or access. They desired scene users that they could trust, and of course cachet led users to prize their access to a given system and ensure that they kept their file transfer ratio in check. The best ways to find the numbers to *sub rosa* BBSes was by asking the sysop of another elite board, reading the message bases of scene systems for advertisements left by other users (there were invariably many of these) or by using the "BBS List" function found on nearly every system. While public domain sysops advertised their BBSes in the various publicly-maintained lists that floated around every area code, private operators preferred an indirect approach based on advertisements backed by informal, word-of-mouth communication between users to fill in the details deliberately left out of the ads. Privileged access was governed by its own multiplier effect: the better one's reputation and knowledge of the scene, the easier it was to find and gain access to other systems.

Once the number to a system had been discovered, an aspiring applicant had to pass through a gauntlet of software-imposed tests designed to determine their status in the scene and whether or not he or she was worthy of access. A New User Password (NUP) was just that: a password an applicant had to enter at the beginning of the signup process prior to entering their basic user information. Three attempts at entering the correct password were typically allowed before the system disconnected the caller, and the passwords themselves were a scarce commodity that other knowledgeable users disclosed with some reluctance as their reputation could be affected if they gave the password out to someone who was either lame or untrustworthy. Systems protected by NUPs were advertisements in and of themselves, as even users who did not know the password would still be afforded a limited glimpse of the system by virtue of its presentation of



Monochrome ASCII NFO file for "Nuclear Assault," a warez board specializing in the trading of ROM dumps of console video games. Users are counselled to contact in-the-know sysops for the system's number and New User Password.[215]

logo or menu ANSIs before logon. As elite BBSes broadcast their status from the moment they took an incoming call, it was maddening to be presented with a taste of a system in the form of its outer defences and then be denied access to the secrets contained within.

Scene bulletin boards divided the signup process into two parts. The first involved entering information common to all BBSes, like the handle, real name, city and state location and phone number of a new user. Some software allowed the asking of these questions to be toggled on or off based on operator preference, with pirate and hacker systems typically asking only for a handle, real-sounding name, location and password. The second phase consisted of filling out system-specific "infoforms," questionnaires designed to elicit information about a user's affiliations, what uploads they had to offer, the names of other BBSes they called, the handles of users who would vouch for them, the speed of their modem, and their ability to recognize the acronyms of groups

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215 Author Unknown, *Nuclear Assault NFO File* (Toronto: n.d., probably mid-1990s), online: http://www.textfiles.com/bbs/ADS/nuc-ass.nfo (accessed March 21, 2009).

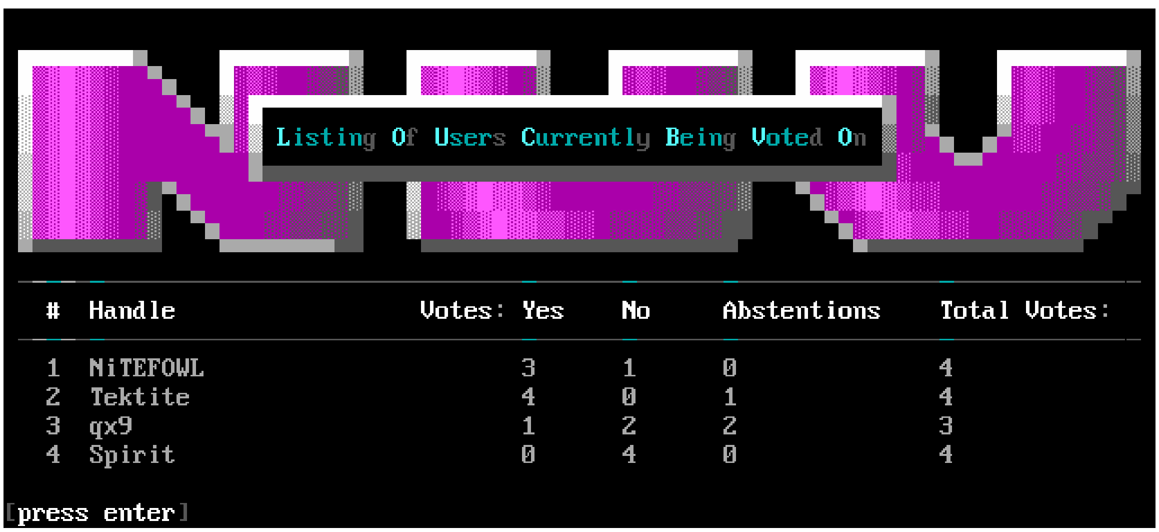
active in the scene. After completing this questionnaire, users typically had to send a private email to the sysop pleading for access and detailing just what they could contribute to the board in the form of warez or specialized information.

Typical user signup infoform, drawn by Manufacturer of iCE for the ViSiON-X BBS software version 0.99, released in 1993.[216]

From here, operators might choose to either manually validate users to full access after reviewing their infoform and application letter or subject them to a vetting process whereby other system users would vote on whether to admit the new applicant. New User Voting programs existed either as add-on applications for mainstream BBS software or as a built-in feature in elite software designed for use in the scene. Examples of the former are packages like Telegard BBS, Renegade BBS and PCBoard, which relied on external programs (this author wrote one such piece of software, now lost to the ages); examples of the latter include LSD BBS, Oblivion/2, Charisma, Vision/2, Vision/X, Iniquity, Impulse and the like. These last packages were genealogically related to each

[216] Manufacturer, "ViSiON-X BBS New User Voting App," in *ViSiON-X BBS Software Version 0.99* (Ottawa: Eid Youssef, December 12, 1995), http://www.bbsdocumentary.com/software/IBM/DOS/VISIONX/visx099r.zip (accessed March 21, 2009).

other, with most claiming descent from the source code of either Forum BBS or the accidentally-leaked source code to the 2.5 version of Telegard. During the voting process, users had an opportunity to review the infoforms of the applicant, see how other users had voted, and leave explaining why they had voted for or against the new user. Similar in a way to the user invitation systems commonly found on contemporary BitTorrent tracker sites, New User Voting enhanced the closed sense of community common to elite BBSes while sharpening the cleavage between those who had privileged access and those who did not. The maintenance of a good reputation was no longer assessed by the sysop alone.



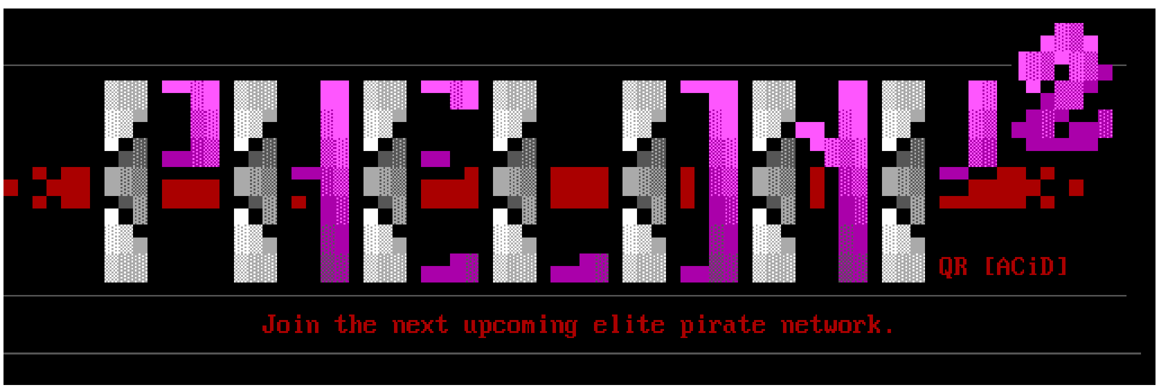
"Listing Of Users Currently Being Voted On" from version 3.1 of Killean's NUVote application for the Renegade BBS software, released in 1994.[217]

Putting It All Together: Elite Systems and the "Config"

Where software piracy and ANSI art intersected was in the centrality of the "config" as a means of signalling elite status. While it was important for an elite BBS to offer privileged information in the form of warez or hacking tips distributed via active

[217] Killean, "List of Users Currently Being Voted On," in *NUVote version 3.1* (Location Unknown: BeerWares Utils, 1994), ftp://archives.thebbs.org/renegade_utils/nuvote31.zip (accessed March 15, 2009).

message boards, so was having a customized set of ANSI screens tailored to the name and feel of a given system. Out of the box, most BBS software provided only minimal, garish menus that did little more than advertise the menu-key combinations required to access the functions embedded in software, though they held open the option of implementing customized menus and prompts like those depicted in Stone Angel's Renegade menu set. The limited brush shape and colour palette provided by Codepage 437 and ANSI made drawing BBS art difficult, and the demand for skilled ANSI artists always outstripped supply. Good artists therefore represented a special caste amongst elite users, and only top-level systems possessed the requisite status to be able to "commission" works by those affiliated with equivalent top-level art groups like ACiD and iCE.



Software piracy and ANSI art united: Quasar's logo for PhelonyNet-2 ("Join the next upcoming elite pirate network,") a FidoNet-style message network for pirate systems. This work appeared in ACiD's December, 1993 artpack.[218]

As with all things in the digital underground, what was sought by artists and sysops alike was status and access to privileged goods. Artists received recognition by the constant display of their signed work to other users through its incorporation into the interface of a BBS, acquired higher-level or ratio-free access to the warez offered on

[218] Quasar, "PhelonyNet/2 Logo," in *ACiD: The Acquisition, December, 1993* (Location Unknown: ACiD Productions, 1993), http://www.textfiles.com/artscene/acid/ARTPACKS/1993/acdu1293.zip (accessed March 21, 2009).

pirated systems, and built the reputation of the groups they were affiliated with by their association with elite bulletin boards. Sysops requesting art advertised their own standing within the scene through their ability to generate the notoriety required to act as a patron to elite artists and paid them in the currency of the trade, namely pirated software and improved standing. ANSI artists carried the advertisement of their group affiliations through to the last callers list of the systems they frequented and the interface artworks themselves; so doing, they put sysops in a better position to secure status as a vaunted "distro" (distribution) site for elite warez and art groups. Early BBS software offered scant options for sysop configuration, usually limited to custom menu screens and prompts instead of the alteration of the hundreds of text strings that represented most of the user-viewable output of the software. Sysops were restricted to editing the binary BBS software overlays in hexadecimal if they wished to change a prompt or, in rare cases, altering the source code of the software itself. The latter was always unusual given the closed-source development model common to the authors of BBS packages.

By the mid-1990s, the centrality of custom art to elite systems, the rise of groups catering to this need and the cleavage between public domain and pirate systems encouraged the development of software that permitted the detailed configuration of all aspects of the interface without having to modify BBS software binaries.[219] While sysops could not modify the program logic of the software they used and were forced to design their systems within the overall constraints of the display paradigm, a greater degree of

[219] See, as an example, Isaac Oates, *Eternity BBS Software version 2.20* (New Jersey: Eternal Software, November, 1995), ftp://archives.thebbs.org/bbs_programs/et220.zip (accessed April 17, 2010); Grant Passmore, *Infusion BBS Software version 1.5 alpha 20* (Location Unknown: July 14, 2009), ftp://archives.thebbs.org/bbs_programs/inf15a20.zip (accessed April 17, 2010); Rob Swindell, *Synchronet BBS Software Version 2.30b* (Yorba Linda, CA: Digital Dynamics, May, 1997), ftp://archives.thebbs.org/bbs_programs/sbbs230a.zip (accessed April 17, 2010); Tim Strike, *Telegard BBS Software version 2.99g1* (Mississauga, Ontario: July, 1995).

customization did become possible. With any moderately capable software containing

Software	Name	Baud	Phone Number
Oblivion/2	The Fringes	14.4k	[216]464-4856
PCB 15.X	Total Devastation	28.8	214-727-9869
Obv/2	Birdhouse vor.fire.relic	28.8	404-947-8035
PCBoard	The Morbid Mess Hall - PMT WHQ	14.40	404-667-9673
IMPULSE	Curmudgeon [LeetAffils]	14400	604-460-0812
obv/2	Bad Landz	14400	817.465.0948
Axis	Wicked Minority	14.4	209-575-4705
Vision-X	Sub Rosa	28.8	407-381-2262
Renegade	Bass Kult - Rave,Drug,Music	14.4	214-240-2017
????	Perpetual Motion	14.4	4162676139
v/2 soon	Crystal Ship Pulse WHQ	14.4K	508-251-4190
obv/2	depths of hell	14400	410-363-6881
O B V / 2	Black Flag <many affils>	14400	508/251-8406
Rgcfg'ed	The Crimson Waters Node 1	14400	613-746-2664
Eternity	ARTiC iNSANiTY	14.4	408-757-7578
MODDEDRG	Tir Aslean · Emerge/Firm	14.4	916.529.5054

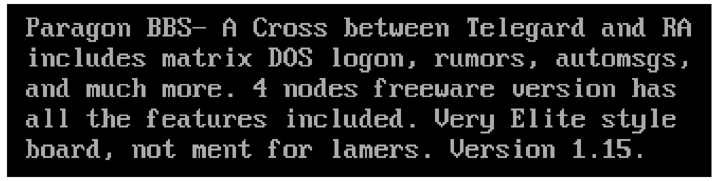
BBS List as viewed through the Oblivion/2 BBS software version 2.30, released in 1995. The names and details of the systems presented here were taken from Nivenh's Impulse BBS software (circa 1995) before being re-imported into Oblivion/2. Note the prominence of elite BBS software (OBV/2, Axis, Eternity, Vision/2), the mentioning of "modded" and "cfg'd" software, and the listing of group affiliations (WHQ, etc).[220]

hundreds of text prompts and dozens of configurable menus, setting up an appropriately "configged" system demanded not only an eye for colour-matching and the creation of an overall theme consistent with its scene orientation, but also dozens of hours of sysop involvement in designing and testing the interface. Executed properly, the result was a BBS that screamed its status virtually from the moment an incoming call was answered, signalling through the juxtaposition of its uniqueness with the bland, canned configuration of public domain systems that having access to it was a sought good in itself.

The emergence of the config as a central feature of elite systems was a product of

[220] The Necromancer, "BBS List," in *Oblivion/2 BBS Software version 2.30* (Location Unknown: Darkflame Enterprises, 1995), ftp://ftp.scene.org/pub/mirrors/artpacks/www/mirrors/acidic/obv2/obv2-230.zip (accessed March 9, 2009).

improvements in the speed of modems, notably the widespread consumer adoption of hardware capable of speeds in excess of 9600 baud starting in 1990. Bulletin boards could sport more graphically-intensive configurations by virtue of the fact that sending complex ANSI artwork down the line was not nearly as slow and laborious as it had been in the era in which speeds below 9600 baud were standard. The same period saw widespread user adoption of cheap, third-party VGA adapters and monitors, devices that permitted them to view the full ANSI colour palette. These two developments explain why ANSI art achieved its apotheosis in the early to mid-1990s.

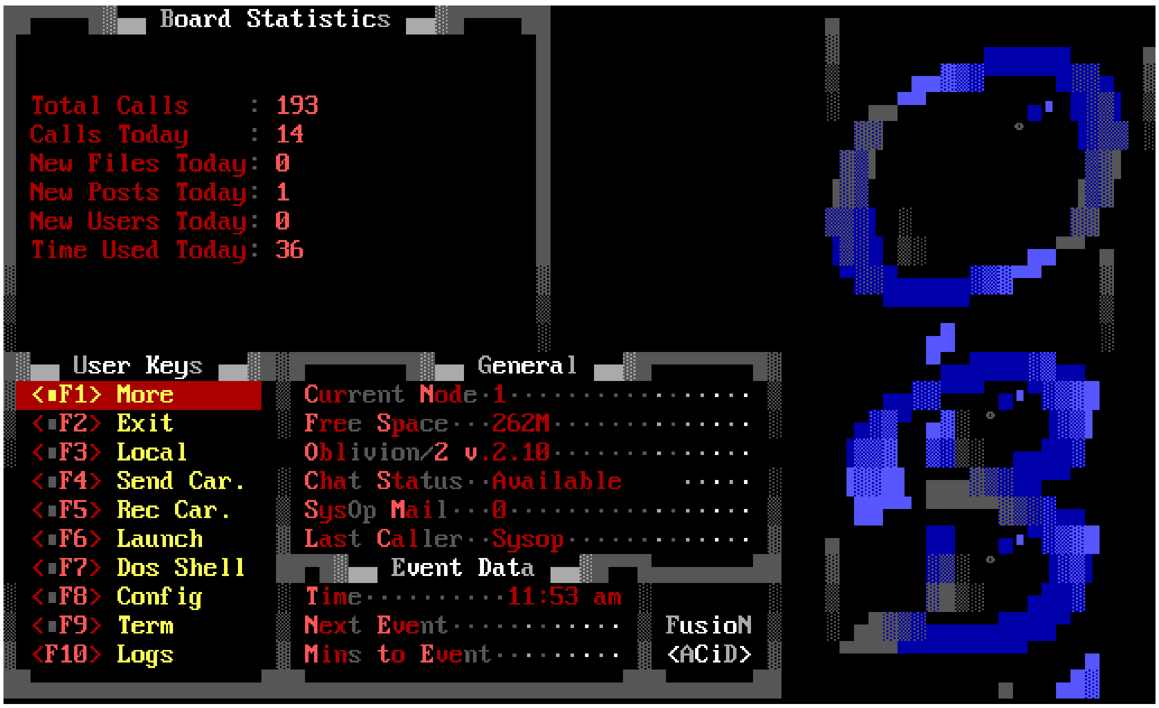


FILE_ID.DIZ (file description) for the Paragon BBS software, an "Elite style" Telegard 2.5 hack released in 1992. The software cannot currently be run in DOS-mode emulation and is not Year 2000 date compliant, but it is emblematic of the role of leaked-code software hacks in the rise of the ethos of the config.[221]

As a matter of history, however, the best tracer of the ethos of configuration lies in canvassing the development of increasingly sysop-configurable BBS software itself. Between 1990 and 1995, BBS packages that explicitly catered to elite operators began to be produced by developers active in the scene. Up until then most pirate BBSes used widely-available commercial software that was adapted to *sub rosa* purposes, a natural application given that software designed for larger, commercial installations contained not only the multinode support required to run a serious pirate system, but also the file ratio and file credit systems that kept the traffic in warez at an acceptably high level. After 1990, numerous source code leaks of public domain software, namely the Telegard and Forum BBS packages mentioned earlier, allowed marginally-talented authors to produce their own "hacks." When compared with their predecessors, these ran the gamut

[221] Refractor, "FILE_ID.DIZ," in *Paragon BBS version 1.15* (Location Unknown, probably Minneapolis, MN: Paragon Software Corp., December 4, 1992), ftp://archives.thebbs.org/bbs_programs/parag115.zip (accessed April 17, 2010).

from packages that provided minimal cosmetic enhancements to those that substantially re-wrote all of the internal subroutines of their predecessors, with subsequent source code leaks leading to additional hacks. [222]



Software piracy, ANSI art and elite BBS software united through the stats screen: Oblivion/2 BBS software version 2.10 (released 1993) waiting-for-caller screen, drawn by FusioN for ACiD's April, 1993 artpack.[223]

As an example, the release of the Forum BBS source code gave rise to the Emulex, TCS, USSR and LSD packages; Celerity BBS was derived from TCS; Oblivion/2, ViSiON/2 and ViSiON/X were derived from LSD, with fragmentation within

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[222] Telegard was originally developed by Martin Pollard and Eric Oman. The source code for version 2.5i leaked sme time after November 20, 1992, if one goes by the dates in the file archive found here: Martin Pollard, *Telegard BBS Source Code Version 2.5k* (Lexington, MI: November 20, 1992), http://www.bbsdocumentary.com/software/IBM/DOS/TELEGARD/tg25src.zip (accessed March 20, 2009); those who wish to follow the history might find the following account interesting: Sabby, "How the Telegard Source got Leaked to the World," in *Everything2* (East Lansing, MI: Everything2.com, March 22, 2001), http://everything2.com/title/How+the+Telegard+Source+got+leaked+to+the+world (accessed March 20, 2009); Spelunking in the source code for Forum BBS reveals the following bibliographic information: Kenneth J. Duda and Ken Boyles, *Forum BBS Source Code, version 2.50* (Location Unknown: March 3, 1989), ftp://archives.thebbs.org/bbs_programs/forum250.zip (accessed March 20, 2009).

[223] The original ANSI is FusioN, "Oblivion/2 2.10 Waiting-for-Caller Screen," in *ACiD: The Acquisition, April, 1993* (Location Unknown: ACiD Productions, April, 1993), http://www.textfiles.com/artscene/acid/ARTPACKS/1993/acdu0493.zip (accessed March 12, 2009); the image depicted above is a screen capture from the software itself: FusioN, "Waiting-for-Caller Screen," in *Oblivion/2 BBS Software version 2.10* (Location Unknown: Darkflame Enterprises, 1993), http://cd.textfiles.com/somuch/smsharew3/MODEM/OBV2-210.ZIP (accessed March 14, 2009).

the ViSiON development team responsible for the competing /2 and /X releases; and the later PiPELiNE BBS was itself derived from ViSiON/X.[224] The leak of the Telegard 2.5 source code, originally a derivation of the WWIV BBS package, gave rise to the Renegade BBS, Impulse BBS, Iniquity BBS, Eternity BBS, Hype BBS and Infusion BBS packages, amongst dozens of others. Most of these were thoroughly short-lived as they were a product of their authors' desire to curry their own elite status by posing as a BBS software programmer or the sysop of a completely unique customized system, but all were united in their near-exclusive orientation towards the needs and pressures of the

Full-screen BBS user login artwork drawn by Zaico of iCE for Time Drome BBS, from the May, 1996 iCE artpack.[225]

digital underground.

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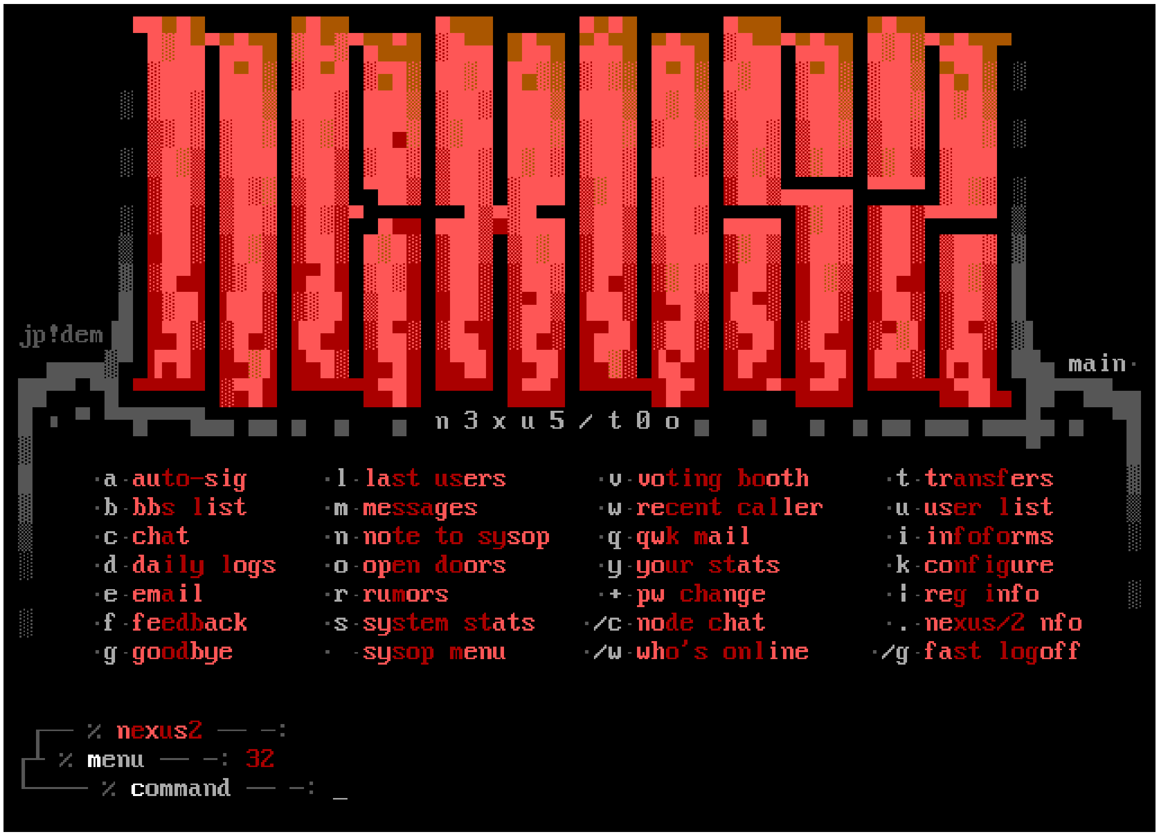
[224] Determining the lineage of derivative software is difficult, but we are fortunate in that the authors of these packages tended to re-use the routines of the parent package from which theirs was hacked without significant modification. This makes the assessment a matter of looking for common built-in configuration or user interface conventions. The similarities between LSD, Oblivion/2, ViSiON/2 and ViSiON/X as an example, are so obvious as to make detailed investigation unnecessary. Software can be downloaded from Pacific Coast Micro's archive at http://archives.thebbs.org/ra103a.htm, and in the "IBM DOS" archive maintained at http://www.bbsdocumentary.com/software/IBM/DOS/.

[225] Zaico, "Time Drome Login Screen," in *iCE Productions May, 1996 iCEPack* (Location Unknown: iCE Productions, May, 1996), http://www.textfiles.com/artscene/ice/icepacks/1996/ice9605a.zip (accessed February 12, 2010).

The artworks showcased in packs released by ANSI groups fall into three broad categories: logos, which were typically less than 25 lines long and which advertised the name of a BBS and little else; screeners, long ANSIs that displayed a complex picture followed by a logo and were shown to callers just after they had first logged in to a BBS; and stats screens, shorter screeners that were explicitly designed to form part of the interface of a BBS. As art groups released only the most impressive works produced by their members, they typically favoured screeners first, logos second, and stats screens last of all. According to the barter-based economics of the digital underground, this was an eminently sensible choice, as drawing non-customized screens for the general pirate BBS operator did little in the way of enhancing the artist's access to pirated software or top systems beyond building his reputation. The key to the scene was always trading favour for favour, "ripping" ANSIs and passing them off as one's own or appropriating them for use on one's own BBS was inherently lame, and no great benefit could be derived from providing generic screens for use by any sysop. Where artists did produce these kinds of works they usually did so for inclusion as part of the set of standard screens that shipped with an elite software package, as this at least guaranteed a much wider audience for their work.

Perhaps the best example of the importance of a customized config to an elite BBS lies in the emergence of BBS "modding" (modification) groups during the peak years of BBS use, namely the period between 1994 and 1998. These were art-cum-configuration groups that provided just the kind of generic BBS customizations art groups typically chose not to produce, combinations of configuration parameters, third-party utilities and BBS software-specific data files that allowed sysops to simply drop in the elements of an elite configuration without having to source their own artwork or



The elite configuration goes mainstream: Nexus/2 custom menu pack by Jack Phlash of Demonic Productions, a BBS modding group active during the dying days of the underground BBS scene.[226]

figure out how to torque the software they used into supporting elite-looking modifications. Operating according to the general organizational structure set by elite warez and ANSI groups, and adapting for themselves the same sort of pithy, acronym-derived group names as their progenitors, their membership built their own elite reputation by catering to the needs of a "mass elite" spawned in the wake of ever-widening BBS use. Groups like TRiC (The Renegade Information Crew), DoRE (Dudes of Revolutionary Enhancements) and ACiD's own ACiDiC modification division

[226] Jack Phlash, *Nexus/2 Menu* Set (Location Unknown: Demonic Productions, January 24, 1997), http://www.demonic.net/files/jp-n2mnu.zip (accessed June 4, 2010). Few mod group releases have survived the jump to the Internet, but WoE Productions is still online at http://wasted.nu, and some of ACiDiC's mods can be found at http://archives.thebbs.org/ra128a.htm. No record of TRiC or DoRE's releases exists.

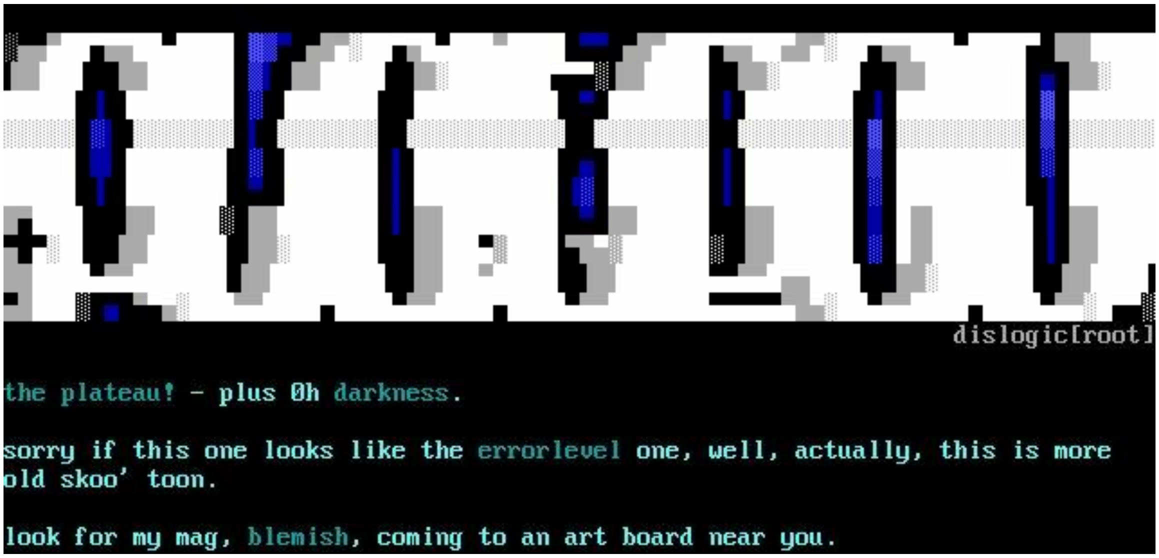
developed small software add-ons that allowed even public domain sysops to ape the unique form and style of the underground.

Through the config, ANSI art, BBS software, interface and elite status combined to produce a generative, interactive artform that was greater than the sum of its constituent parts. For the users of these systems, ANSI art was never the point in and of itself. Instead, it served as a backdrop for electronic social interaction and, most importantly, the exchange of information. Viewed in this light, the artistic elements of a config are similar to the public art installations that have graced the walls, windows and other architectural features of train stations, libraries, courthouses and places of worship since time immemorial. ANSI art branded a system, signalling its nature and alignment to its users; it codified the values users were expected to adhere to while telegraphing the status of the system to those who were expected to conform to its norms. Much like the stained glass of a church or the coat of arms found in any Canadian courtroom, ANSI demonstrated how the "place" that was an elite BBS was meant to be used and the power wielded by those who owned it.

Grouping Up Elite: Membership and the Competition for Status

The analysis of ANSI art presented here is inextricably linked to the availability of documents – the ANSIs themselves – that serve as its evidentiary foundation. While ANSI art existed prior to 1990, the artworks created in this precursor period are not accessible to historians. They were created by individual artists for use on discrete systems whose records did not survive the jump from the circuit-centric operating environment of the dial-up BBS to the network-centric environment of the contemporary Internet. The examples of ANSI art that are still available through the websites of scene collectors have survived the slow attrition of obsolescence because they were packaged in a form that encouraged their archiving, namely the artpacks released by dedicated ANSI groups between 1992 and the end of the decade. These were compressed libraries of multiple files, released monthly by groups large enough to meet this production schedule, that showcased the works created by their members and, as was the case with popular groups who achieved national or international notoriety in the digital underground, were uploaded to BBSes far and wide.

Certain factors made artpacks amenable to archiving in ways that single artworks were not. Packs carry with them data sufficient to categorize them, like the group that released them and, subject to limitations, the date of their release. They reduce file management headaches by presenting logos or screeners within a single file. Most importantly, the notoriety of the groups that released them ensured that many parallel copies of them were created as they were transferred between systems and users. When the initial excitement generated by the rise of the Internet had faded to the point that users began to feel nostalgic for the BBS scene, those who participated in it sought to recapture what records of its existence they could. Sites like Sixteen Colors (http://sixteencolors.net), ANSIArt.org.ua (http://ansiart.org.ua), the BBS archive maintained by Pacific Coast Micro (http://pcmicro.com/bbs), Textfiles.com (http://textfiles.com) and modern ANSI group Blocktronics (http://blocktronics.net), all of which were created by former scene members, have been instrumental in providing the primary documents used here. An example of the surprising, organic persistence of specimens of ANSI art and the power of parallel copies lies in the fact that this author found screeners and logos from his own BBS, "Plateau," on Sixteen Colours some ten years after they were inadvertently deleted. This was possible only because they happened to appear in a 1997 artpack released by a group with which their original creator was affiliated – and this pack somehow managed to be picked up by an online archive.



The Internet has a surprisingly long memory: long-lost logo artwork from Plateau, this author's bulletin board system, recovered from Sixteencolors.net in 2007. This piece was used as the header for all of the BBS' menus.[227]

While the reasons why ANSI artists began to band together into dedicated groups cannot be demonstrated by recourse to the sources themselves as such a specific enunciation of principle is not found in the documents, they are explicable by reference to the same first principles that have animated much of the analysis presented here. First, ANSI groups provided the traditional advantages of specialization of function and the division of labour that underlie all group affiliations: if the object is to attempt to disseminate goods to as wide an audience as possible, achieving this is made easier by assigning dedicated personnel to the functions of production, packaging and distribution. Within ANSI groups, these roughly corresponded to the work of artists themselves, the

[227] Dislogic, "Plateau," in *Root Productions, March, 1997* (Ottawa: Root Productions, March 4, 1997), http://sixteencolors.net/packs/1997/root0397.zip (accessed June 7, 2009).

efforts of group administrators and senior members, and of course the couriers whose responsibility was the transferring of artpacks to affiliated systems. In this ANSI groups become an informal analogue of vertically-integrated businesses, with artists, administrators, couriers and operators of distro sites acting as producers, production managers, logistics specialists and retail outlets respectively. Second and more importantly, however, ANSI groups and the "affilz" they carried allowed their members to gain enhanced access to both the sought goods of the scene and the bulletin board systems that acted as their purveyors. Group membership brought with it the recognition of elite status that defined inner-circle membership in the digital underground and distinguished top-level users from the "lamers" that defined the mass.

Membership list from iCE's March, 1994 artpack. Headed by then-president Tempus Thales, the group is divided into senior staff, staff advisors, directors of the ANSI, literature, artist trial and couriering divisions, and the artists themselves.[228]

[228] iCE Productions, "Membership List," in *iCE Productions March, 1994 iCEPack* (Location Unknown: iCE Productions, March, 1994), http://www.textfiles.com/artscene/ice/icepacks/1994/ice-9403.zip (accessed June 9, 2010).

What is clear, though, is that the structure and activities of ANSI groups were not an innovation particular to these associations, but instead the adaptation of an organizational and operational template originally devised by warez groups and initially seen on computer platforms whose users had developed a mature pirate scene long before that of the IBM PC. In the beginning, the cracking and distribution of commercial software was an individual, informal enterprise; warez groups existed in the early Apple scene, but they did not achieve anywhere near the reach IBM warez groups did in the 1990s. For reasons of chronological overlap and platform-specific technical capability, the example that seems to have served as the template for IBM warez (and ANSI) groups was the vibrant pirate scene of the Commodore 64, which achieved its fullest flowering during the mid- to late 1980s: the Commodore 64 was the premier gaming machine during this period, and its decline roughly corresponds with the IBM PC achieving sufficient multimedia capabilities to act as a decent gaming platform. Groups like Fairlight, whose cracktro from "Black Lamp" was depicted in chapter 2 and which was a descendent of West Coast Crackers, a Swedish Commodore 64 warez group, organized software piracy according to the spreader / cracker / release group / courier / distro site system described earlier.[229] These groups reached out to talented coders, who acted both as crackers and intro authors, as well as computer hackers and telecoms fraud specialists whose knowledge of phone system and network arcana permitted the widespread distribution of releases at reduced cost.

From the membership lists included in art packs released by ACiD and iCE, which feature a division of responsibilities between senior staff, staff advisors and

[229] Defacto2.net, "Fairlight (FLT) Group Page," in *Defacto2: The Scene Archives* (Newark, DE: Defacto2, May 12, 2010), http://www.defacto2.net/groups.cfm?mode=detail&org=flt (accessed June 5, 2010).

division leaders, couriers, and ANSI, VGA, music, coding, and literature artists, the adaptation of the organizational structure of warez groups to the art scene can readily be seen. Some of ACiD's membership lists even feature a "telecoms division" which was responsible (amongst other things, which may well have included collecting calling cards for the couriers) for maintaining the national voice mailbox couriers were expected to call to receive information about upcoming releases.[230] In ANSI, piracy and all other substrata of the digital underground, release packaging and organization into groups are proof of the appearance of a "mature" scene as they demonstrate both a formalization of group activities and an orientation towards mass production and distribution. These same criteria tend to distinguish cottage industries from their capital-intensive counterparts.[231]

Proof of the development of a just such a pirate scene on the IBM PC can be found in the NFO files released by the individuals and groups that cracked and packaged releases. Even more so than artpacks, these number of these sources have been steadily diminished by obsolescence: while an artpack is collectible in its own right, a release NFO file is tied to a specific, now-ancient piece of software whose value has steadily diminished over time as it was replaced by newer releases, and of course what is now sought for archival or retro-gaming purposes is the software itself instead of its packaging information. Fortunately the archives at textfiles.com (http://textfiles.com/piracy) and defacto2.net (http://defacto2.net) have retained a collection of period NFO files,

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[230] ACiD Productions, "Membership List," in *ACiD: The Acquisition, March, 1993* (Location Unknown: ACiD Productions, March, 1993), http://www.textfiles.com/artscene/acid/ARTPACKS/1993/acdu0393.zip (accessed June 9, 2010); ACiD Productions, "Membership List," in *ACiD: The Acquisition, June, 1993* (Location Unknown: ACiD Productions, June, 1993), http://www.textfiles.com/artscene/acid/ARTPACKS/1993/acdu0693.zip (accessed June 9, 2010); ACiD Productions, "Membership List," in *ACiD: The Acquisition, October, 1995* (Location Unknown: ACiD Productions, October, 1995), http://www.textfiles.com/artscene/acid/ARTPACKS/1995/acdu1095.zip (accessed June 9, 2010).

[231] Alfred Dupont Chandler, *Visible Hand: The Managerial Revolution in American Business* (Cambridge, MA: Harvard University Press, 1977).

membership lists, interviews with warez traders and, somewhat astonishingly, brief screen captures of users connected to elite systems that provide a glimpse into the workings of the scene.[232]

What these files demonstrate is that full-fledged warez groups dedicated to the IBM PC platform did not develop prior to 1990, or at least did not make a sufficiently large impact on the scene for their NFO files to survive the technological jump off of dial-up systems. A far greater number of sources created in the crossover period between the era of the BBS and that of the Internet (roughly 1996-1999) have survived. This conclusion is supported by files that attest to the emergence of couriering-only IBM PC groups – those that did not crack or package releases, but simply shipped them around for others – like UC (United Couriers) and RiSC (Rise in Superior Couriering) beginning in 1992.[233] Defacto2.net's chronological list of warez groups, found at http://defacto2.net/groups.cfm and http://defacto2.net/timeline.cfm, shows that most of the top groups in the warez scene of the 1990s formed during the early years of that decade. More importantly, the names of systems featured in such documents as Calyph's World BBS Listing strongly correlate with the screener and logo advertisements released by elite ANSI groups during the same period.[234] As expected, they also demonstrate that the greatest concentration of elite BBS systems was within those states or markets that

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[232] The screen captures housed at Defacto2.net are worth viewing, as they show period artworks as they appeared on pirate systems. See Defacto2.net, "Bulletin Board Systems" in *Defacto2: The Scene Archives* (Newark, DE: Defacto2, 2010), http://www.defacto2.net/bbs.cfm (accessed June 5, 2010). A primary document repository is available at http://defacto2.net/documents.cfm

[233] United Couriers, *United Couriers Board List* (Location Unknown: October, 1992), http://www.textfiles.com/piracy/COURIERS/uc1092.nfo (accessed June 6, 2010); RiSC (Rise in Superior Couriering), *Membership List* (Location Unknown: December, 1992), http://www.textfiles.com/piracy/COURIERS/risc1293.nfo (accessed June 6, 2010). RiSC began as a couriering-only group, but eventually grew into a full-fledged warez group.

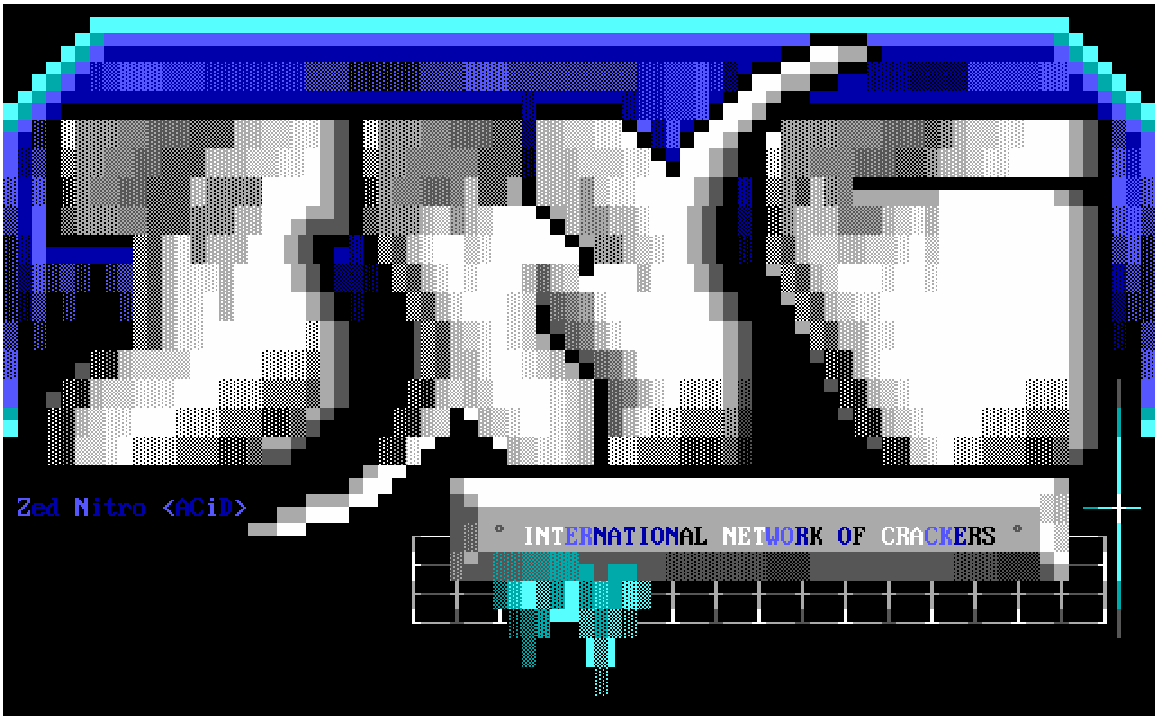
[234] Cayliph, *The Globelist World BBS List* (Location Unknown: KRS, October 4, 1993), http://defacto2.net/dl/documentstxt/TheGlobeList.txt (accessed June 8, 2010); Flashback, *The World Elite List 1.0* (Canada: TRiSTAR / Red Sector, 1994), http://defacto2.net/dl/documentstxt/TRSI1GUIDE.txt (accessed June 8, 2010).

were sufficiently prosperous as to permit the mass ownership of microcomputers, namely Europe, the United States and Canada.

Although the principal route to status within the pirate scene lay with grabbing and spreading the latest releases, the technical skills required to crack software presented a formidable barrier to entry. By 1990, very few game releases shipped without advanced copy-protection schemes designed to channel users towards purchasing software instead of simply downloading it. Circumventing copy protection required crackers to be intimately familiar with the arcana of machine-language programming and the use of disassemblers, abilities possessed by relatively few. Given the availability of programs like TheDraw, however, alternate avenues to status presented themselves: while programming required a significant investment in self-directed study, the creation of ANSI art demanded little more than the adaptation of innate artistic ability to the peculiar constraints of the medium. Craving eliteness and group membership, those members of the digital underground that did not attempt to gain their reputation by trading software, running a pirate BBS, programming demos or cracking software used art, a sought good in itself once the technological capabilities of the IBM PC and the pirate scene it supported matured, to gain recognition and affilz. As RaD Man, founder of ACiD and its precursor group Aces of ANSI Art put it when addressing the Notacon Conference in 2005,

> I'm sure you guys all know back in the 1990's it was really cool to be in a group. That was the cool thing to do. If you couldn't get into a group, if you had no skills, then... create your own group! Right? Why not? And so, that's what these people did. They said "I can't crack games, and I can't code this. I can draw ANSI though! So I'll create Aces of ANSI Art." We started seeing that come along in 1989. That in turn, led to the formation of ACiD. Members of Aces of ANSI Art disbanded and

formed a group called ACiD in 1990.[235]



Synergy between the warez and ANSi art scenes: Zed Nitro's logo for the International Network of Crackers, which appeared in ACiD's August, 1993 artpack.[236]

By the mid-1990s, hundreds of warez, ANSI, BBS modification and similar groups were active in the digital underground, a fact again attested to by the collections of digital flotsam that have survived to the present. Competition between groups is made obvious by polite- and less-than-polite ribbing given to members of rival groups that frequently appear in ANSI art. As the values of the art scene were inflected by those of the warez scene that both preceded and sustained it, the means by which ANSI artists and groups sought to compete with each other were substantially the same. Groups fought with each other to gain the membership of the best-reputed artists, produce logos and screeners that were longer or more life-like or featured more intricate shading and design.

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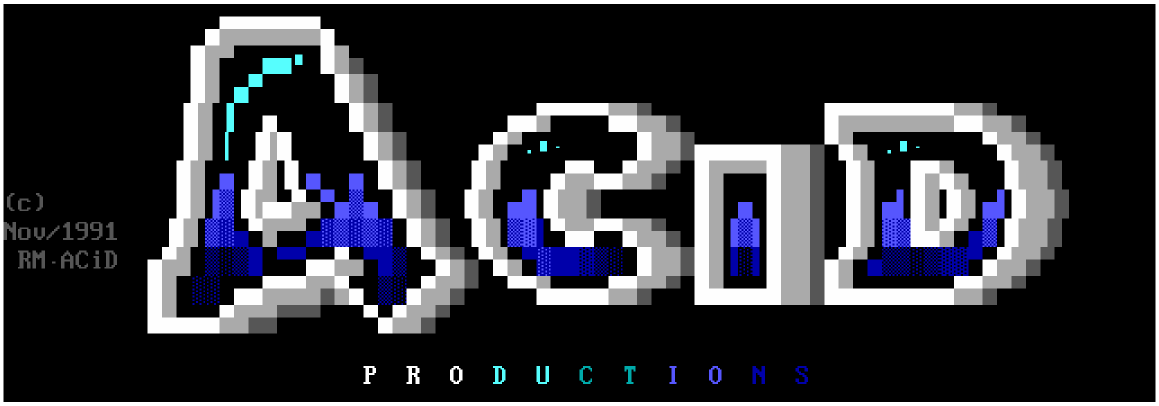
[235] Jason Scott and Christian Wirth, "100 Years of the Computer Art Scene" (presentation at the NotACon Conference, Cleveland, OH, April 23-25, 2004), http://www.cow.net/conned/notacon/artscene/notacon-100artscene-transcript.txt (accessed June 9, 2010).

[236] Zed Nitro, "International Network of Crackers," in *ACiD: The Acquisition, August, 1993* (Location Unknown: ACiD Productions, August, 1993).

Larger groups also sought to develop the software tools that permitted the greatest breadth of artistic expression and the most visually appealing (read: high resolution) means of displaying the works. Through the use of member boards and distro sites that displayed the works of individual, group-affiliated artists, ANSI groups sought to draw their artists into a closed community of patronage and recognition that would inhibit their transferring allegiance to their rivals. Finally, through the interplay of recognition and respect between groups in parallel sectors of the digital underground, namely the separation between ANSI creators and warez distributors, membership incentivized itself: rolling with a crew provided the means to access ever-more-elite systems while evading the elaborate mechanisms designed to keep less desirable users out.

Genre-setters: ACiD and iCE

With few exceptions, the artworks presented here are drawn from two groups: ANSI Creators In Demand (ACiD) and the Insane Creator's Enterprise (iCE). These were the largest, most prolific and most well-recognized groups active in the underground BBS scene between the emergence of ANSI groups in the early 1990s and their virtual disappearance by the end of the decade. Their selection is no accident, as their popularity ensured that the majority (if not all) of their artpacks survived to the present, their history is relatively traceable when compared to that of other groups, and the quality of the artworks their members produced generally surpasses that of their competitors. Finally, the elevated status of these two groups within the scene and their sheer size, two mutually-reinforcing facets that defined their success, make them exemplars of the organizational structure of BBS art groups generally.



An early ACiD logo advertising the group. This artwork does not appear as a standalone ANSI in any official ACiD pack, though it did appear atop the membership list during the early period of the group, but instead has been taken from what remains of the original "The Acquisition" packs. Drawn in November, 1991, one presumes that "RM" was RaD Man himself.[237]

ACiD was founded by RaD Man, also known as Chris Wirth, in southern California in 1990. ACiD was Worth's response to the directionless leadership of Aces of ANSI Art, possibly the first organized ANSI art group, which he joined after producing a long-forgotten two-colour logo for a local hacking group called Hackers Enterprising Across Telecommunications (HeAT). Although an ANSI artist himself, and certainly not one lacking in talent, it was his leadership and organizational abilities as well as his familiarity with telecoms fraud that allowed his group to achieve the status that it did. ACiD thrived on the back of hacked voice mail boxes and conference bridges, which coordinated the activities of its couriers, and the stolen calling cards that allowed them to dial up long distance systems for free. ACiD may also have been responsible for the development of the artpack format itself, as its ANSIs were originally distributed in a single, ever-growing archive called the ACiD Acquisition. This persisted until its size made it time-prohibitive to download, at which point the group switched to monthly compilation and distribution:

[237] RaD Man, "ACiD Logo," in *ACiD: The Acquisition, November, 1991* (Location Unknown: ACiD Productions, November, 1991), http://www.textfiles.com/artscene/acid/ARTPACKS/1992/acdu0892.zip (accessed May 4, 2009). The logo appears at the top of the membership list for the August, 1992 Acquisition, though it indicates it was drawn earlier.

> “The Acquisition” – Contains A-Z of the ANSi collection. Background history: The Acquisition was originated [sic] in San Jose, California. After it had been organized and its contents sorted, it first appeared on Fear and Loathing BBS. To this day the original zips are still floating around, but as more and more high quality computer graphics are produced, the more tighter [sic] the zipped volumes become.[238]

ACiD began as an ANSI-only art group, but a review of its membership lists from 1992 onwards reveals a tendency towards both increasing organizational sophistication and expansion into other forms of digital expression. In June of 1992, the earliest artpack this author could find on the Internet, ACiD contained three senior staff members and 32 “artists / members,” with no distinction between them; six bulletin board systems were listed as “agoras,” or regional hubs, while an additional five served as province- or state-level “outposts.”[239] An official couriering division appeared in August, along with an increase in the number of affiliated bulletin board systems; by September, “member boards” began appearing in the lists.[240] The telecom division made emerged in March of 1993, and VGA Artists, Coders, Musicians and coordinators for the various divisions were first listed in June of that year.[241] ACiD artists did not begin producing standalone high-resolution (VGA) art until October, 1993, when RIP (Remote Imaging Protocol)

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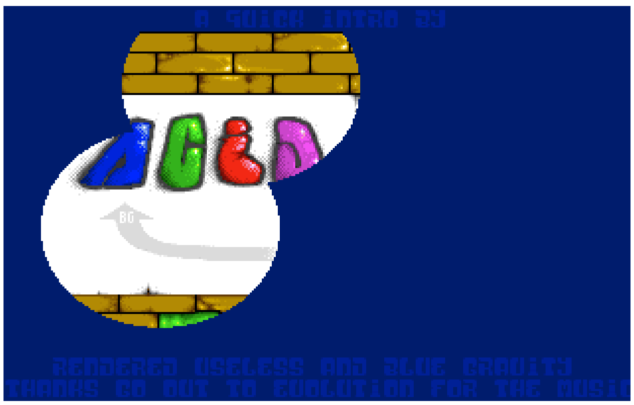
238 RaD Man, “June, 1992 Acquisition NFO,” in *ACiD: The Acquisition, June, 1992* (Location Unknown: ACiD Productions, June, 1992), http://www.textfiles.com/artscene/acid/ARTPACKS/1992/acdu0692.zip (accessed May 5, 2009).

239 ACiD Productions, “Membership List,” in *ACiD: The Acqquisition, June, 1992* (Location Unknown: ACiD Productions, June, 1992), http://www.textfiles.com/artscene/acid/ARTPACKS/1992/acdu0692.zip (accessed May 5, 2009).

240 ACiD Productions, “Membership List,” in *ACiD: The Acquisition, August, 1992* (Location Unknown: ACiD Productions, August, 1992), http://www.textfiles.com/artscene/acid/ARTPACKS/1992/acdu0892.zip (accessed May 5, 2009); ACiD Productions, “Membership List,” in *ACiD: The Acquqisition, September, 1992* (Location Unknown: ACiD Productions, September, 1992), http://www.textfiles.com/artscene/acid/ARTPACKS/1992/acdu0992.zip (accessed May 5, 2009).

241 ACiD Productions, “Membership List,” in *ACiD: The Acquisition, March, 1993* (Location Unknown: ACiD Productions, March, 1993), http://www.textfiles.com/artscene/acid/ARTPACKS/1993/acdu0393.zip (accessed May 5, 2009); ACiD Productions, “Membership List,” in *ACiD: The Acquisition, June, 1993* (Location Unknown: ACiD Productions, June, 1993), http://www.textfiles.com/artscene/acid/ARTPACKS/1993/acdu0693.zip (accessed May 5, 2009).

VGA graphics were first included in ACiD artpacks.[242] Until that point, one presumes that VGA artists produced background images for use in the EXE (executable) loaders, essentially "cracktro" BBS advertisements, that were the responsibility of the coding and music divisions. Proper VGA graphics were first featured in January, 1995, though by that time members of the VGA Division had been folded back into the generic category of "artists."[243]



Animated cracktro-style VGA loader by Rendered Useless and Blue Gravity of ACiD, released in the May, 1994 artpack. Most of the work created by VGA division artists prior to January, 1995 was featured in loaders such as this.[244]

ACiD spun off an ASCII art subdivision called Remorse in December of 1994.[245] Although ANSI remained the preferred BBS artform during this period, there was a parallel demand for ASCII art due to the technological constraints of the medium: ANSI could not be embedded in the advertisements displayed by file-archiving software when a user unpacked an archive, typically was not supported in the automatic import of FILE_ID.DIZ file descriptions by BBS software, and could not be sent down the line until a caller's terminal emulation had been detected. This last limitation of standard

[242] ACiD Productions, "Membership List," in *ACiD: The Acquisition, October, 1993* (Location Unknown: ACiD Productions, October, 1993), http://www.textfiles.com/artscene/acid/ARTPACKS/1993/acdu0893.zip (accessed May 5, 2009).
[243] ACiD Productions, "Membership List," in *ACiD: The Acquisition, January, 1995* (Location Unknown: ACiD Productions, January, 1995), http://www.textfiles.com/artscene/acid/ARTPACKS/1995/acdu0195.zip (accessed May 5, 2009).
[244] Rendered Useless, "ACiD VGA Loader," in *ACiD: The Acquisition, May, 1994* (Location Unknown: ACiD Productions, May, 1994), http://www.textfiles.com/artscene/acid/ARTPACKS/1994/acdu0594.zip (accessed May 23, 2010).
[245] Remorse, "Membership List," in *Remorse ASCII Pack #1* (Location Unknown: Remorse, December, 1994), http://www.textfiles.com/artscene/acid/ARTPACKS/1994/rmrs-01.zip (accessed May 9, 2009).

BBS configurations meant that any system advertisements transmitted as part of the splash screens displayed by FidoNet-compatible front-end mailers between when they answered the phone and invoked the underlying BBS software, an increasingly prevalent setup during the mid-1990s, had to be displayed in plain text. Given that ANSI was tied to Codepage 437 and thus the IBM PC platform, ASCII was also platform-independent in a way that ANSI was not. As the Internet began to displace the BBS, this platform independence permitted ASCII art to reassert itself as the preferred mode of expression on Internet hosts that needed such artwork.

Beginning in August, 1995, the influence of the Internet can be seen in ACiD's membership lists, as this is when the addresses of web and FTP sites hosting artpack archives first appear.[246] In January of 1996 the aliases of members appear beside their Internet email addresses, typically hosted at acid.org. [247] Notable in this is the fact that artist addresses referencing hosts attached to the various FidoNet-compatible pirate networks or FidoNet itself never appeared in the lists in spite of ACiD releasing numerous logos for FTN networks during its reign. The reason for this delineates the key difference between the archipelago-like nature of dial-up BBSes when compared to that of Internet hosts. One could never realistically list a FTN-connected network address unless one was the sysop of the system in question as it was impossible to guarantee the long-term viability of the address as a point of contact. Bulletin board systems and FTN networks operating in the digital underground were ephemeral, suffering as they did from

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[246] ACiD Productions, "Membership List," in *ACiD: The Acquisition, August, 1995* (Location Unknown: ACiD Productions, August, 1995), http://www.textfiles.com/artscene/acid/ARTPACKS/1995/acdu0895.zip (accessed May 5, 2009).

[247] ACiD Productions, "Membership List," in *ACiD: The Acquisition, January, 1996* (Location Unknown: ACiD Productions, January, 1996), http://www.textfiles.com/artscene/acid/ARTPACKS/1996/acdu0196.zip (accessed May 5, 2009).

high rates of attrition through change in scene affiliation and operator interest – as well as attention from the authorities.

In spite of the fact that 1996 represented the high-water mark of the number of deployed BBS systems worldwide, by October of that year ACiD had abandoned monthly artpacks in favour of a numbered system of archived releases which featured more high-resolution graphics and less ANSI.[249] At that time, the membership list of the group contained 28 official affiliate BBSes, seven web and FTP sites and some 130 artists, though by the middle of the next year only nine official boards were left.[250] Membership remained consistently high throughout the period of the group's decline, probably because the affiliation still carried weight in an Internet-connected world that had not

This artwork, entitled "Ghengis' Final ANSI," represents one of the last examples of ANSI art produced by ACiD before it focused its attention exclusively on high-resolution graphics. From The Acquisition #56, April, 1997.[248]

[248] Ghengis, "Ghengis' Final ANSI," in *ACiD: The Acquisition #56* (Location Unknown: ACiD Productions, April, 1997), http://www.textfiles.com/artscene/acid/ARTPACKS/1997/acid-56.zip (accessed June 10, 2010).
[249] ACiD Productions, *ACiD: The Acquisition #51* (Location Unknown: ACiD Productions, October, 1996), http://www.textfiles.com/artscene/acid/ARTPACKS/1996/acid-51a.zip (accessed June 10, 2010).
[250] ACiD Productions, "Membership List," in *ACiD: The Acquisition #58* (Location Unknown: ACiD Productions, June, 1997), http://www.textfiles.com/artscene/acid/ARTPACKS/1997/acid-58.rar (accessed June 10, 2010).

forgotten its bulletin board precursors, but by early 2000 the group was not releasing art on anything approximating its old schedule, and by 2003 it had given up the ghost. The BBS was gone and long since forgotten, replaced by web and FTP sites, relay chat systems and online message boards, and the commoditization of digital image editing software in the form of Photoshop had made high-resolution artworks merely another adjunct of website design. ANSI, of course, had been abandoned long before.

Despite its exceptionally short reign, one which corresponded with the brief transition period during which the overall capabilities of the IBM PC platform were held back by available networking technology, ACiD was responsible for scene innovations that defined the state of the art during the brief period of ANSI ascendancy. As stated previously, it developed its own ANSI viewer in the form of ACiDView and an enhanced ANSI editor called ACiDDraw. [251] It created a means by which artist information could be stored invisibly in ANSIs by way of tags, a specification it called SAUCE (Standard Architecture for Universal Comment Extensions) and SPOON, a field editor that allowed such tags to be added to artworks.[252] Feeling the limitations of IBM ANSI, it even developed its own proprietary format for storing ANSI ART, XBin.[253] This permitted the creation of works with up to 65536 rows and columns, an alternate, user-selectable palette of colours, multiple text mode fonts, and internal compression. This was in essence a high-resolution adaptation of ANSI, an attempt to revitalize the form in light of

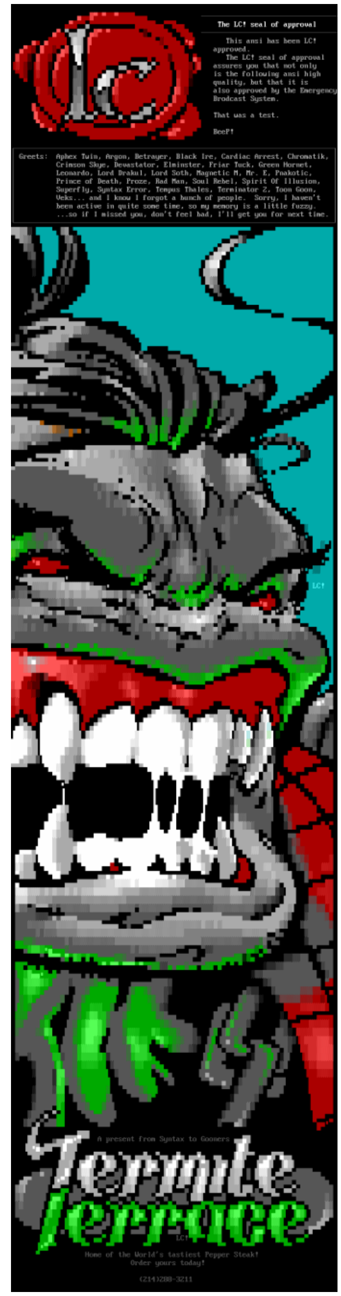
[251] Skull Leader, *ACiDDraw version 1.25R* (Location Unknown: ACiD Productions, September 1, 1999), http://download.com.com/3000-2192-10141644.html?tag=lst-0-1 (accessed June 12, 2010); Skull Leader, *ACiDView Version 4.36f* (Location Unknown: ACiD Productions, December 21, 2002), http://www.acid.org/ftp/avd-436f.zip (accessed June 12, 2010).

[252] Tasmaniac, "What is SAUCE?" in *Acid.org* (San Jose, CA: ACiD Productions, n.d.) http://www.acid.org/info/sauce/s_what.htm (accessed June 10, 2010); Tasmaniac, *SPOON II for DOS, version 1.61* (Location Unknown: ACiD Productions, May 5, 1999), ftp://artpacks.scene.org/mirrors/artpacks/programs/dos/editors/spn2d161.zip (accessed June 10, 2010).

[253] Tasmaniac, "The Official XBin Homepage," in *Acid.org* (San Jose, CA: ACiD Productions, October 1, 1998), http://www.acid.org/info/xbin/xbin.htm (accessed June 11, 2010).

the new, advanced graphics adapters widely available to users of the IBM PC, but it was never widely adopted. The market had already moved on.

The origins of iCE, ACiD's principal rival, are more obscure. The group released its first artpack in August, 1992 and, if the listings for its headquarters BBS systems are any indication, formed in either Texas or Virginia, though the fact that the majority of its early member systems were located on the east coast of the United States supports the latter notion.[255] It is difficult to determine who founded the group as the membership lists from its earliest packs do not indicate who the senior members are.[256] Most authorities hold that a French Canadian warez trader named Many Axe was responsible for its creation, but this seems implausible given the relative lack of official iCE affiliate BBSes in Canada during its early period, the fact that Many Axe does not appear in the earliest available membership lists, and that another artist named Lord Mischief operated the iCE post



"Termite Terrace," drawn by Lord Carnuss for the June, 1995 iCEPack.[254]

[254] Lord Carnuss, "Termite Terrace," in *June, 1995 iCEPack* (Location Unknown: iCE Productions, June, 1995), http://artscene.textfiles.com/ice/icepacks/1995/ice-0695.zip (accessed June 12, 2010).
[255] iCE Productions, *August, 1992 iCEPack* (Location Unknown: iCE Productions, August, 1992), online http://artscene.textfiles.com/ice/icepacks/1992/icepk-08.zip (accessed June 12, 2010).
[256] The best we have is from the December, 1992 and January 1993 iCEPacks, which lists Lord Mischief, Force Ten, Metal Head and Tempus Thales as senior members. Early releases do not identify founders. iCE Productions, "Membership List," in *December, 1992 iCEPack* (Location Unknown: iCE Productions, December, 1992), http://artscene.textfiles.com/ice/icepacks/1992/icepk-12.zip (accessed June 12, 2010); iCE Productions, "Membership List," in *January, 1993 iCEPack* (Location Unknown: iCE Productions, January, 1993), http://artscene.textfiles.com/ice/icepacks/1993/ice-0193.zip (accessed June 12, 2010).

office box out of McLean, Virginia. By January of 1993, the senior staff of the group consisted of Metal Head, Force Ten, Lord Mischief and Tempus Thales, with the latter two continuing to serve in a senior capacity until late 1995.[257]

iCE displayed an organizational structure and overall trajectory similar to that of ACiD, a fact that testifies to the viability of the scheme pioneered by the former and the warez groups that preceded it. Its early NFO files give due credit to the influence of its predecessor, describing the "iCEPack [as] a monthly release from iCE™ Advertisements, similar to that of ACiD™ Productions, which showcases all of the artwork that has officially been released by iCE for that month."[258] Although the quality of iCE ANSIs was initially lower than those of ACiD, bearing in mind the fact that some of the members of the latter had acquired a few years' drawing experience through Aces of ANSI Art, after 1995-6 the overall quality and quantity of iCE artwork was greater than that of ACiD. While the size of the membership lists of both groups remained large when compared with the number of works featured in the artpacks of each and both placed an increasing emphasis on VGA artwork as the decade proceeded, iCE remained true to the ANSI form by continuing to release BBS art until it closed shop in December, 2002. By that point, however, the ANSIs produced by the group did not advertise BBSes proper, but instead iCE generally – the BBS had long since lost its privileged position as a site of information interchange.[259]

Over the course of its existence, iCE came to acquire all of the accoutrements of a

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[257] iCE Productions, "Membership List," in *September, 1995 iCEPack* (Location Unknown: iCE Productions, September, 1995), http://artscene.textfiles.com/ice/icepacks/1995/ice-9509a.zip (accessed June 12, 2010).
[258] iCE Productions, "Distribution Sites List," in *January, 1993 iCEPack* (Location Unknown: iCE Productions, January, 1993), http://artscene.textfiles.com/ice/icepacks/1993/ice-0193.zip (accessed June 12, 2010).
[259] iCE Productions, *December, 2002 iCEPack* (Location Unknown: iCE Productions, December, 2002), http://www.textfiles.com/artscene/ice/icepacks/2002/ice-200212.zip (accessed June 12, 2010).

mature ANSI art group: it developed its own artpack viewer called iCEView, a drawing program called iCEDRaw, proprietary VGA-mode palette extensions called iCEColor, and eventually its own custom, binary ANSI format similar to XBin.[260] It divided its operations into ANSI, VGA and couriering divisions, though it never appears to have developed a standalone digital music division like ACiD did with its Phluid spinoff.[261] It expanded into Internet distribution at approximately the same time, roughly 1995, and it expired under the influence of much the same pressures.[262] What distinguishes the two groups is the fact that ACiD's software development (coding) and VGA divisions displayed much greater prowess than those of iCE, but in all cases the quality of intro/cracktro software and high-resolution graphics produced by groups using the IBM PC was inferior to those who took the Commodore family of computers, with their enhanced multimedia capabilities, as their platform of choice.[263] iCE was also

[260] iCEView actually appeared in iCE's first pack, but was called "AV": Author Unknown, "iCEView," in *December, 1992 iCEPack* (Location Unknown: iCE Productions, December, 1992), http://artscene.textfiles.com/ice/icepacks/1992/icepk-12.zip (accessed June 12, 2010). The earliest version I found that was released in a proper iCEPack is Friar Tuck, "iCEView 0.64," in *April, 1995 iCEPack* (Location Unknown: iCE Productions, April 30, 1995), http://www.textfiles.com/artscene/ice/icepacks/1995/ice9504a.zip (accessed June 12, 2010). Copies of iCEDraw and the specification for iCEColor proved remarkably elusive, but as both are repeatedly mentioned in the iCEView documentation and that of other drawing programs there is no doubt they existed. See Frederic Cambus, *ANSILove,* (Location Unknown: SourceForge.net, June 16, 2009), http://ansilove.sourceforge.net/ (accessed June 12, 2010).

[261] The division into ANSI, VGA and Code units appears as early as January of 1993: iCE Productions, "Membership List," in *January, 1993 iCEPack* (Location Unknown: iCE Productions, January, 1993), http://www.textfiles.com/artscene/ice/icepacks/1993/ice-0193.zip (accessed June 12, 2010). There is a music division listed in the membership list for July of 1993 which persists for some time after that, but iCE never spun it off into its own group: iCE Productions, "Membership List," in *July, 1993 iCEPack* (Location Unknown: iCE Productions, July, 1993), http://www.textfiles.com/artscene/ice/icepacks/1993/ice-0793.zip (accessed June 12, 2010).

[262] iCE Productions, "Distribution Sites List," in *June, 1996 iCEPack* (Location Unknown: iCE Productions, June, 1996), http://www.textfiles.com/artscene/ice/icepacks/1995/ice-9506.zip (accessed June 12, 2010).

[263] This comparison has to be adjusted in light of the differing periods in which the DOS-based IBM PC and Commodore 64 were most active, as the latter achieved its ascendancy approximately ten years before the former. The judgment is made in light of the relative capabilities of each platform: Commodore 64 artists who produced cracktros and high-resolution graphics were arguably more skilled than those that did so on the IBM PC when the quality of the work produced is assessed in light of the system-spec limitations under which they worked.

iCE's final ANSI, "High on iCE" by Mongi and Primal_r, released in the December, 2002 iCEPack.[264]

responsible for the creation of several underground FidoNet-style networks, notably Cybercrime International (CCiNet), which linked aligned systems together across North America.[265] As with all endeavours in the digital underground, these were predictably short-lived.

While the original impetus for ANSI art was the pirate BBS scene, by approximately 1996 a new species of BBS began to emerge: the dedicated art board. In Europe, where the intro/cracktro demoscene was much stronger, systems devoted to showcasing computer artwork and providing a forum for communication between artists had long existed, but these

[264] Mongi and Primal_r, "High on iCE," in *December, 2002 iCEPack* (Location Unknown: iCE Productions, December, 2002), http://www.textfiles.com/artscene/ice/icepacks/2002/ice-200212.zip (accessed June 12, 2010).

[265] See, as an example, Metal Head, "CyberCrime," in *April, 1993 iCEPack* (Location Unknown: iCE Productions, April, 1993), http://www.textfiles.com/artscene/ice/icepacks/1993/ice-0493.zip (accessed June 12, 2010).

focused on performing graphic design in software rather than the use of ANSI. They thus preferred the Commodore series of microcomputers, which were initially more price-accessible than PCs and proved more long-lived in the European market. By this time a substantial proportion of warez trading had shifted to the Internet, which preferred the platform-independence of ASCII art over Codepage 437. In this it is notable that ACiD's Remorse ASCII division appeared approximately at the beginning of this trend and continued through to the end of ACiD as a driving force in computer art.

The emergence of "art for art's sake" bulletin board systems symbolized both the ultimate maturity of the form as well as the beginning of its decline, for once the link between warez trading and ANSI art had been severed the principal motivation for creating such works effectively disappeared. What was the point of creating ANSI artwork if it would only be admired by other artists? To this a better question can be added: what was the point of creating ANSI artwork if most artists dedicated the use of their scarce phone line to dialling up to the Internet and idling on relay chat instead of calling bulletin board systems? The answers to these questions speak to the technological shift that eliminated the form, the natural final subject of this essay.

The Internet and the End of the Form

That the Internet killed the BBS – and with it its premier art form, ANSI – there can be no doubt. From an estimated high of several tens of thousands of connected systems in 1996, by the turn of the century the BBS had been all but displaced by the Internet, at least in western, industrialized economies. While various attempts to adapt the BBS to the Internet were attempted, either through preserving its original, single-connection orientation through Telnet-connected boards or by transforming BBS packages into multi-protocol (web / FTP / Usenet news / email) Internet suites, neither of these solutions proved capable of forestalling decline of the medium.[266] The three technological developments that underlay both the success of the Internet and the death of the BBS represented attempts to overcome the internal contradictions inherent in the paradigm of the telephone-connected microcomputer, contradictions that sprang from the fact that while processing power had become commoditized, network access had not. Each attempt is related to the next, representing connected facets of an integrated solution to a definable market problem. Stated simply, these developments were the adoption of a connection-oriented, dedicated network interface in the place of the circuit-oriented adaptation that was the analog, public switched telephone network-connected modem; the elimination of artificial geographic barriers that defined the addressing scheme of the phone network and permitted the usage-based monetization of network access; and the use of platform- and device-independent protocols, the glue that bound the first two together.[267]

Bulletin boards were always scarce resources because of the circuit-driven nature of the telephone network. Only one caller could connect to one BBS node via one

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[266] BBS software authors first used Telnet-enabled FOSSIL (Fido Opus SeaDog Standard Interface Layer) drivers to put BBSes that could only address serial ports on the Internet, but a number of Internet-specific softwares were created in the late 1990s. Rick Moore, *FSC-0015: Fundamentals of FOSSIL Implementation and Use* (Homewood, IL: FidoNet Technical Standards Committee, 1988), http://www.ftsc.org/docs/fsc-0015.001 (accessed June 22, 2010); PC Micro, *NetFoss Internet FOSSIL for Windows, version 1.03* (Thousand Oaks, CA: Pacific Coast Micro, July 20, 2010). WorldGroup was perhaps the largest commercial adaptation of BBS software to the Internet: see GalactiComm, *Worldgroup* (Laurel, MD: netVillage.com, 2009), http://www.gcomm.com/ (accessed June 22, 2010). For similar packages, see AdeptSoft, *AdeptXBBS Version 1.11y* (Boca Raton, FL: AdeptSoft, 1997), ftp://archives.thebbs.org/bbs_programs/adf111y.zip (accessed June 22, 2010); Kim B. Heino and Tapani T. Salmi, *BBBS version 4.01 Flag* (Turku, Finland: January 28, 2007), http://www.bbbs.net/ftp/bbbs_nt.zip (accessed June 22, 2010). An example of a more standard period adaptation is Michael Pike, *Iniquity BBS Software version 1.01* (Atlanta, GA: July, 1997), ftp://archives.thebbs.org/bbs_programs/iq101dos.zip (accessed June 22, 2010).

[267] Those looking for a good (if technical) introduction to the TCP/IP protocol suite should consult T. Solofsky and C. Lake, *RFC 1180: A TCP/IP Tutorial* (Edinburgh, UK: Spider Systems / Network Working Group, January, 1991), http://tools.ietf.org/html/rfc1180 (accessed June 26, 2010).

telephone line at a time; all other callers who attempted to dial in while another user was on the system would receive a busy signal. This limited the number of callers that could be handled in a given day as well as the scalability of bulletin board systems, which required ever-increasing numbers of independent phone lines to efficiently serve a large audience. The Internet Protocols (IP) overcame this limitation by using a connection-oriented scheme in which any number of virtualized circuits could be connected over a single "line," subject of course to the overall bandwidth limit of the physical transport. Instead of a plethora of incoming analog telephone lines, the end-user provisioning of network access was simplified through the use of a single carrier medium, be it the telephone company-supplied and short-lived Integrated Systems Digital Network (ISDN), the much longer-lived Asynchronous Digital Subscriber Line (ASDL), or various coaxial cable, Ethernet or fibre-optic solutions. Furthermore, a single connection could serve users connecting to a server through any number of different application-layer protocols, the signalling mechanisms that sit atop TCP/IP and drive current web (HTTP, the Hypertext Transport Protocol), file-sharing (FTP, the File Transfer Protocol, as well as BitTorrent), email (SMTP, the Simple Mail Transport Protocol, as well as POP, the Post Office Protocol and IMAP, the Internet Mail Access Protocol) and instant-messaging services (XMPP, the Extensible Messaging and Presence Protocol, amongst many others).[268] A single server could support any or all of these protocols in software without the need for additional equipment.

The analog modem had always been something of a hack, an adaptation of consumer electronics technology to the most widely-available consumer-grade network.

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[268] Jacob Palme, *Internet Application Layer Protocols and Standards* (Stockholm: Institutionen för Data- och Systemvetenskap, DSV Stockholms Universitet, n.d.), http://people.dsv.su.se/~jpalme/abook/ (accessed June 26, 2010).

This was most obvious in the way that computers communicated with each other over phone lines, as they attempted to adapt the limited bandwidth available in the frequency range most amenable to the carrying of voice conversations to the transmission of data. As described previously, this placed a strict upper limit on how much data could be sent down the line: even with advanced compression and error-correction technology, no analog modem could transmit data at more than 33,600 kilo*bits* (4.2 kilobytes) or receive data at more than 56,000 kilobits (7 kilobytes) per second.[269] With a typical high-resolution image occupying between twenty and 200 kilobytes or more and tens of them used on modern web pages, it is unsurprising that the early world-wide web was painfully slow for the vast majority of Internet users who, in its initial surge of popularity, connected to Internet Service Providers using dial-up modems. The true network access revolution began when so-called broadband connection technology filtered down to the price-point of the average consumer, a development that began in earnest around the year 2000 and which continues to this day.

Although most consumer broadband technologies represented another adaptation of an existing physical network (typically cable or telephone) to the problem of network access, what distinguished them from their analog precursors was the fact that they were explicitly designed to deliver *digital* data and utilized a much fuller frequency spectrum of the underlying physical medium. These were hacks in themselves, given that the physical infrastructure of networks in question had not been deployed with the delivery of digital data to the consumer in mind, but they were hacks that proved far better at

[269] These are raw figures that do not account for protocol overhead; nominal speeds were at least ten percent lower. In addition, 56,000 kilobit connections required the installation of special equipment and were thus only used by Internet Service Providers. Please see the reference to the V.90 protocol standard at note 172 for more information.

unleashing the bandwidth-carrying capabilities of these networks – and, through their use as frameworks for TCP/IP, eliminated the circuit-driven approach that was the hallmark of the telephone era. The vast improvement in capability typified by Canadian cable Internet access, which in 1999 delivered data rates at of approximately 200 kilobytes per second and in 2010 can now push data at over five *mega*bytes per second, speaks to the adaptability of designed-for-digital delivery.[270] So doing, this overcame the key, lagging bottleneck in overall PC platform capability, namely the speed at which these systems could be connected to a wide-area (as opposed to local-area) network.

In itself, this represented a great commercial advantage: systems could be connected more easily and at a greater overall speed than ever before, a fact that revolutionized the rate of inter-user information interchange and permitted more effective leveraging of the personal computer, which completed its invasion of the desktops of most home and business users during the same period. More significant than this, however, was the fact that Internet access enabled instantaneous, generally non-tariffed access to a truly global network. To end users, who typically do not pay backhaul carriage rates for the transmission of their data through the various peering points that are the central synapses of the Internet, area codes and per-minute charges became a much-reviled emblem of an earlier, carrier-centric system of network access.

Coupled with TCP/IP and application-layer protocols, high-speed processing and high-speed network access broke apart not just the geographic hegemonies of the telephone companies, but in many respects the influence of geography itself over the

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[270] Rogers Communications, *Press Release: Rogers Continues to Deliver the Fastest Internet, Period* (Toronto: Rogers Communications, July 9, 2009) https://www.rogers.com/web/link/showNewsDetail?fromWhere=linkInRSSXml&rssBusiUnit=C&NewsID=1707094972 (accessed June 28, 2010).

organization of business entities and user communities. Freed from the constraint of the area code, these communities came to be defined solely by the alignment of language or interest rather than physical distance, in the process transforming them into truly transnational, globalized organizations. Whether controlling software development in Mumbai from a head office in New York or sharing the same video between viewers in Kentucky and Kuwait, the Internet allowed individual operators and users to cost-effectively speak to the world in a way that the telephone network did not.

Both of these developments likely would have proven fatal to the BBS on their own, given that they undid the fundamental market *raison d'etre* of the BBS as a distributor of sought goods, but latent in the strength of the Internet protocols was another aspect of their use that proved particularly poisonous to ANSI art. This was platform independence, the fact that TCP/IP was thoroughly agnostic when it came to the hardware and operating system choices of the systems that could speak the language of the protocol suite. As demonstrated by the ecology of the BBS environment, bulletin board systems were platform-specific: although terminal emulation meant that all modem-connected systems could theoretically speak to each other, individual idiosyncrasies between platforms and platform-derived divisions of interest segregated BBS users and operators according to their microcomputer hardware of choice. Apple BBSes catered to Apple users, a product of the particular way in which Apple systems displayed plain text; IBM PC systems carried the warez sought by their users; and the same was true for those that preferred the Commodore 64, Amiga or Macintosh platforms.

When it came to ANSI art, the block-drawing characters and available colour palette were the product of Codepage 437 and ANSI.SYS, implementations that were specific to the IBM PC and did not translate well to other systems. TCP/IP and the application-level protocols that rode atop it knew no preferred means of displaying the information they transported: they were designed to implement simple information interchange, with client software determining how that information was shown to the end user. An email client that speaks SMTP can be designed in text mode or as an adjunct to a graphical user interface; a web browser can render the same page on a computer or a mobile phone, devices with vastly different display capabilities.

With the above, protocol and circuit independence affected the way that online services were delivered. A dial-up link to a BBS unified software functionality, form and interface within a single connection, with the host bulletin board system providing all of the processing power and disk storage needed to use the resources of the system. Modem-connected clients were essentially microcomputers transformed into dumb terminals: all dialler software was required to do was read the keystrokes of the user and translate the ANSI codes sent down the line from the board. File transfers occupied the same channel as that used to draw the interface, meaning that a user could not simultaneously download a file and use other functions of the system. The replacement of this archaic arrangement by a client/server model in which standard protocols were used to transmit information from the server while client software running on the user's computer figured out how to display the data permitted users to take advantage of modern, multitasking operating systems and graphical user environments to do more – and do it all at the same time. It was no longer necessary to hold oneself to 80 by 25 characters and sixteen colours, as the display of transmitted data through application software was instead a function of the operating system that hosted the application and the ingenuity of the designer who programmed it. This eliminated the unique immersiveness of the BBS environment, the feeling that one was being drawn into an unfamiliar, remote system rather than simply using its services, but the advantages the new paradigm represented for end users made this a minor distinction whose passing was not mourned.

For all of the above reasons, the Internet simply offered more than bulletin board systems were capable of even at the peak of their technological power, subject as they were to relatively fixed constraints that limited their ultimate utility. Internet access was faster, cheaper, more adaptable to concomitant developments in personal computer capability, and permitted greater end-user productivity. All of the functions traditionally provided by BBSes, from public messaging and private email to file transfers, could be accomplished more easily, efficiently or reliably through the rich, application-layer protocols that drove the services provided by Internet-connected hosts. Internet email provided a single point of contact between the user and the world in a way that BBS private mail or FidoNet Netmail could not, given that it was wedded to the fortunes of a single system and the desire on the part of its operator to keep it running. File transfers could be accomplished in the background and at greater speed than they could via dial-up, and the opportunities for anonymity offered by the new mask of the Internet Protocol address and the ability to site hosts in warez-friendly jurisdictions made FTP sites and BitTorrent the preferred means of distributing pirated software. Public messaging, whether accomplished through UseNet or web-based message boards, allowed users to connect to a larger audience than before and embed multimedia content with greater ease than could be accomplished via the BBS. Finally, by allowing any individual with knowledge of HTML to become a global publisher in his or her own right and any reasonably adept developer to market the next killer app to a much larger online public, the web itself presented opportunities far greater than those offered by the geographically-bounded bulletin board.

All that was missed in this was the unique sense of local mystery that was the act of connecting to a BBS, for it was possible that the online denizens of local bulletin boards were people, hiding behind the mask of the handle and the smaller-scale anonymity of the terminal and area code, that one might pass in the grocery store or look past on the local bus without any knowledge of their other self. The same condition still persists in the Internet age, albeit with the a diminished sense of regionality – one matched by better opportunities to conceal the virtual self within a larger mass and behind the oceans of data that now flow through the fibre-optic networks of the world. Many feel a sense of nostalgia encouraged by the replacement of one paradigm of online interaction with another, superior paradigm, but none so greatly that they would prefer the return to a more primitive online world. The advantages of the Internet are too great, and in the case of the generation of young people who have only known email, Facebook and MSN Messenger, they lack the historical consciousness of the differences between the bulletin board and the contemporary meaning of "online" to sense the passing of what is truly dead and gone.

ASCII Reborn

While ANSI art is definitively finished as a popular art form, existing as it does now as a curio produced only by those who originally participated in the scene, one of the ironies of Internetization is the fact that ASCII art, ANSI's precursor, has reasserted itself as a viable mode of expression. The reason for this is simple: ASCII is platform-independent in a way that Codepage 437-derived ANSI is not, given that written text expressed through individual characters continues to be the predominant mode of electronic information interchange. Modern personal computers and digital devices can still display text much more easily than they can ANSI, which when it is not converted into a high-resolution digital image now demands the installation and configuration of operating system emulators and ancient device drivers.

Similarly, and in a concession to their origins, modern warez groups still include ASCII NFO files as a means of describing their releases, and the aesthetics of their logos are scarcely different from those of their predecessors. NFO viewers and editors, all of which rely on ASCII alone, are available as software packages for all contemporary operating systems. Much as a WordPerfect or WordStar document is platform- or application-dependent in a way that printed text or typewriter art is not, given that these last two require no special software to convey meaning to the reader, ASCII is resilient in a way that ANSI could never be. ASCII demands only a text editor, and as of 2010 these are still a staple (Notepad, Wordpad, SimpleText, EMACS, Vim, Kate) of modern operating systems. While the constraints of operating environment and platform were responsible for the ultimate form of ANSI art, so too were these same factors equally responsible for its disappearance.

Final Thoughts

The preceding exercise sought to satisfy three goals. The first was to use ANSI art as a lens through which the eparadigm shift, technological operating environment and ethos responsible for a particular form of online interaction could be drawn into focus.

ANSI represented a response to a market paradigm shift that placed microcomputers within the hands of a consuming mass, operated within a framework defined by a unique, identifiable set of technological constraints, and served a social function as a signifier of status, membership, and a gateway to a definable set of sought goods. It was an art form unique in its digital unification of form and function, acting as it did as the form of the interface that defined the early era of online collaboration during the period of initial microcomputer adoption. It retained its relevance so long as the operating environment that sustained it proved capable of solving definable market problems, and its day in the sun ended when other, organic paradigm shifts fundamentally changed the way in which online interaction took place by devising solutions to the contradictions inherent in the original paradigm. Regardless of its displacement by these new solutions, the imprint of the BBS and ANSI art is still visible in the way contemporary online communities are organized: many of the innovations peculiar to this first age of mass online communication persist in the form of authentication mechanisms and schemes designed to control user behaviour employed by systems that act as the new brokers of the same set of sought goods. Status may be defined differently and warez may be both larger in size and traded using a different set of technical tools, but the desire for both has only grown stronger in the Internet era.

The second was to demonstrate that history is adaptable to the unique challenges of the digital age. While the tools and techniques of the craft – painstaking research and patience – are the same as they were when Herodotus composed his *History,* the nature of documentary evidence and the definition of what qualifies as a document have been altered by pervasive digitalization. History *can* be written using the kind of short-lived, difficult-to-authenticate sources that are created in ever-greater numbers as information interchange and community participation moves away from physically-bounded documents and towards those that exist solely in the virtual domain. Doing so requires the relaxation of both the rules of historical evidence and the influence of some of the presumptions that define the genre – the present-minded fallacy foremost amongst them – if historians are to successfully adapt their work to the world of today. The increasingly rapid pace of change, itself a product of access to instantaneous global communications, demands that the timeframe of what represents a respectable object of "true" historical inquiry be shortened lest the effect of obsolescence render sources unavailable. Finally, if history is to retain its relevance and currency its practitioners must drink deeply of the convergence between the social, the economic and the political, encompassing entities for whom the recording of meeting minutes and other errata is never considered. Expediency demands that the evidentiary assumptions carried forth from the period in which history became a professional discipline must yield to the demands of the present.

The last was to palliate the nostalgia of this author for an online era since passed by academicizing his experience with it, presenting a record that overcomes the unpleasantness of *temps perdu* by crystallizing what has been forgotten within the amber of text. Efforts at documenting this peculiar past have been made by amateur historians, but so far this subject has escaped the attention of academic commentators and the unique skills of reconstruction and rational autopsy they can import to the enterprise. For those that see within the digital domain the vast, latent potential for historical inquiry such research represents, this essay is meant to serve as an example that such work can and should be done.

As with all historical works, this narrative opens as many lacunae as it sought to fill, and interested inquirers will be left with questions that will hopefully animate their own research. The Scandinavian demoscene, still active in 2010, should be picked apart much as the North American ANSI scene was dissected here. The operations of individual art groups, including (for lack of a better way of describing it) the intertextuality that propelled the development of the form can be examined. The hacker ethos that drove the technological innovation of microcomputer hobbyists and the industry they spawned, long the subject of established (but often non-academic) historical research, can be brought into the fold. The evolution of software piracy and various other forms of illegal, *sub rosa* online activity represent but another potentially rich seam, as does the development of personal computer digital music from the PC Speaker through to the sample-based music epitomized by the MOD and S3M file formats. For those that are willing to truly engage with digital technology and bring to their research the array of techniques that define the vitality of the profession, the field is virtually unlimited.

V

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