Environment and Planning A 2003, volume 35, pages 1261 – 1286

DOI:10.1068/a35105

Underground globalization: mapping the space of flows of the Internet adult industry

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Received 8 April 2002; in revised form 19 December 2002

Abstract. This paper develops a case study of the Internet adult industry in order to study the ways in which electronic commerce interacts with geography. Digital products, low barriers to entry, cost differentials, and sensitivity to regulation have created a pervasive and complex geography of models, webmasters, and consumers around the globe. With a series of specially developed datasets on the location of content production, websites, and hosting it is shown that the online adult industry offers people and places outside major metropolitan areas opportunities to become active purveyors of this type of electronic commerce. The roles of these actors, however, are not simply determined by a spaceless logic of cyber-interaction but by histories and economies of the physical places they inhabit. In short, the 'space of flows' cannot be understood without reference to the 'space of places' to which it connects. This geography also provides a valuable counterpoint to mainstream electronic commerce and highlights the ability of socially marginal and underground interests to use the Internet to form and connect in global networks.

Communication technologies have long been intertwined with urban and economic geography. Innovations from improvements in mail transportation to the real-time interaction offered by the telephone have played important roles in shaping urban agglomerations and the structure of the economy (Abler, 1977; Pool, 1977; Pred, 1973). The Internet is the most recent manifestation of this process and has allowed people and places to connect and interact in new ways, and in so doing has helped shape what Castells (1989; 1996) refers to as "the space of flows". This process, however, does not undermine the relevance of distance and places but provides the means for the reconstitution and reorganization of social connections and geographic concentrations at all levels within the economy.

This paper expands the discussion of the multiplicity of ways that the commercial Internet is developing through a case study of the Internet adult industry. Despite its size and diffusion, the online adult industry has been the subject of relatively little academic research. Digital products, low barriers to entry, cost differentials, and sensitivity to regulation have created a pervasive and complex geography of models, webmasters, and consumers around the globe. In particular, the online adult industry offers people and places outside major metropolitan areas opportunities to become active purveyors of electronic commerce; albeit of products rarely acknowledged or sought by advocates of connectivity. The roles of these actors, however, are not simply determined by a spaceless logic of cyber-interaction but by histories and economies of the physical places they inhabit. This geography provides a valuable counterpoint to mainstream electronic commerce and highlights the ability of socially marginal and underground interests to use the Internet to form and connect in global networks.

The Internet and economic geography

Analysis of Internet geography builds upon an earlier research agenda on telecommunications and geography that has been the subject of an increasing amount of research over the past fifteen years (Brunn and Leinbach, 1991; Castells, 1989; Graham and

Marvin, 1996; Hepworth, 1989; Kellerman, 1993; Moss, 1986; 1987). Despite this existing scholarship, the widespread adoption of the Internet in the early 1990s led many pundits—largely outside of geography and urban studies—to predict that the Internet was destroying the relevance of geography and cities (Cairncross, 1997; Gilder and Peters, 1995; Negroponte, 1995; 1999). Although these ideas captured the popular imagination, a body of literature in the last half of the 1990s shows that the Internet has concentrated within developed countries and/or urban agglomerations (Brunn and Dodge, 2001; Dodge and Shiode, 2000; Hargittai, 1999; Kolko, 2000; Malecki, 2002; Moss and Townsend, 1997; Townsend, 2001a; 2001b; Zook, 2000; 2001). These researchers argue for a nuanced understanding of the Internet's effect on geography.

Cyberspace and space of flows

Building upon this research, geographers emphasize the complex geographies that result from the interaction between communications and Internet technologies and existing organizational, economic, political, and regulatory structures (Graham and Marvin, 2001; Leinbach and Brunn, 2001; Wheeler et al, 2000). Activities that entail intense interaction or rely upon tacit knowledge exchange will likely continue to be concentrated in major urban centers (Leamer and Storper, 2001; Lo and Grote, 2002). Other activities such as distance learning or medical checkups may be adaptable to Internet connections although likely will also require intermittent face-to-face meetings. Routine and well-prescribed activities such as call centers and data entry may be located anywhere with good telecommunications and a supply of suitably trained workers (Richardson and Gillespie, 2000a; 2000b). This results in complex organizational and geographical structures even within a single activity such as the music industry (Leyshon, 2001).

Although telecommunciations technologies create opportunities for radically new locational patterns their use is also shaped by preexisting circumstances and structures. As Mitchell asserts,

> "Cities will evolve down varying paths. Global cities like New York and London will, no doubt, seek to strengthen their positions as command and control centers .... Communities that have been marginalized through isolation or poverty will try to improve their condition through remote education, telemedicine and other kinds of electronically delivered low-cost services .... All will seek the advantages that make the most local sense" (Mitchell, 2000, pages 143 – 144).

A number of studies support Mitchell's argument by showing that significant disparities exist between regions' access and use of the Internet (Aoyama, 2001; Moss and Townsend, 2000; O'Kelly and Grubesic, 2001; Wheeler and O'Kelly, 1999).

Castells theorizes this interaction between the historical legacies of places and new communications technologies as the formation of a "space of flows" that connect places to a global network of economic and other activities. Castells (1996, page 413) argues:

> "The space of flows is not placeless, although its structural logic is. It is based on an electronic network, but this network links up specific places, with well-defined social, cultural, physical, and functional characteristics. Some places are exchangers, communications hubs playing a role of coordination for the smooth interaction of all the elements integrated into the network. Other places are the nodes of the network, that is the location of strategically important functions that build a series of locality based activities and organizations around a key function in the network .... Both nodes and hubs are hierarchically organized according to their relative weight in the network. But such a hierarchy may change depending upon the evolution of activities processed through the network."

In short, simply because a technology allows something to locate anywhere does not mean that it will. The web-based interface to the Internet provides the illusion of a realm divorced from the socially constructed markets and systems of exchange built over decades and centuries. This perception, however, belies the continual influence of places and their regulatory and economic systems on telemediated interactions. Even an industry based on digital products cannot avoid this effect. Rather, the characteristics of localities, which Castells (1996) calls the "space of places", determine the structure of the network and each place's relation (or irrelevance) to it.

Internet connections, underground networks, and black holes

One of the best examples of a space of flows is the world's financial system of global cities (Sassen, 1991) and offshore banking locations (Roberts, 1994) which play different yet essential roles. While Castells notes that world cities research is an important strand of inquiry he also highlights other spaces of flows, most notably criminal networks such as the Russian mafia and the illegal narcotic trade (1996, page 414; 1998, pages 166 – 205). The low cost and decentralized structure of the Internet is particularly beneficial for these background activities because it offers an inexpensive yet relatively secure means of global communications.

These criminal networks include access to major markets and protection for the key actors in the network in places which are beyond the reach of the law-enforcement efforts of these markets. This safety can be achieved through coercion, corruption, or open alliance with the political regime in place. The relationship between the A1 Qaeda network and the Taliban is the most resonant example of this but is far from the only one. Thus, the geographical manifestation of these networks shares a similar structural logic with the global financial system, albeit with drastically different priorities, goals, and relevant places.

Also included in Castells's theory of the space of flows, albeit largely in reference to their marginality, are people and places without meaningful roles in the dominant space of flows that "shift to a position of structural irrelevance" and are characterized as the "black holes of informational capitalism" (1998, page 162). Often connected to criminal economies and largely divorced from the mainstream, these excluded places and populations also have a distinct and global geography. These geographies, however, are constructed around exclusion rather than connection. As Castells (1998, page 164) argues:

> "The territorial confinement of systemically worthless populations, disconnected from networks of valuable functions and people, is indeed a major characteristic of the spatial logic of the network society ... a new world, the Fourth World, has emerged, made up of multiple black holes of social exclusion throughout the planet ... it is ... present in literally every country, and every city."

Thus, the theory of space of flows encompasses a wide range of global networks from the mainstream to the criminal to the excluded. Research on nonmainstream space of flows, however, has been relatively sparse. In large part this is because of the difficulty in identifying and tracking networks, which by their very nature have little interest (and in some cases a strong disinterest) in the identification and analysis of their connections. This difficulty is increased by the highly decentralized nature of the Internet that enhances the ability of furtive activities to create global networks that are largely unseen.

In this paper I address this gap by examining a socially marginal yet highly commercial activity on the Internet, the creation, distribution, and consumption of pornography. The adult industry is a good case study because its products have long been socially stigmatized and legally prosecuted, leading to agglomerations in certain

cities with more permissive standards such as Los Angeles and Amsterdam. Distribution and consumption of adult materials have likewise been prohibited, policed, and pushed to the margins of cities and society. The digitization of its product and the creation of new distribution channels have greatly altered this geography. The transfer of pornographic images can now be accomplished on fiber optic cables over the highly decentralized and largely unregulated network of the Internet. Consumption of these materials no longer necessitates a trip to a video or book store but can be done with the click of a mouse. Even the barriers to entry in the production of this content have been lowered with the introduction of digital cameras and photo or video editing software. This has greatly expanded the number of participants in the industry and dispersed the organization of production. Historic centers of the offline adult industry still remain important but the production and distribution of online products show a marked pattern of dispersion. The technology of the Internet does not itself determine the structure and role of various hubs, nodes, and black holes but offers new possibilities for participation, interaction, and exploitation between spatially distant actors that had little or no connection previously. The geography of the Internet adult industry shows that the resulting geography is not simply random but connected to the histories and economies of the physical places. Thus, rather than a simple annihilation of space there is a restructuring of connections between places that reorients and compresses time–space into new configurations and hierarchies represented by the space of flows.

The perfect Internet industry?

The Internet adult industry is defined as adult-oriented websites that are accessible to the entire Internet community and offer pornographic images, audio, video, text, and chat to visitors. The content of these websites reflects the wide variety of sexual interests of Internet users and for the most part these websites are commercially driven. Websites with a particular type of content were not specifically targeted and instead this analysis reflects the entirety of the industry.

It is important to note that the definition used in this paper does not include important distribution channels such as newsgroups, bulletin board services, and peer-to-peer systems of exchange. Although these outlets are important to the online adult industry[1] they are difficult to capture using the methodology of this paper and are often noncommercial in nature, for example, the exchange of images or conversation by individuals. The analysis of this paper also does not include illegal Internet activities such as child pornography or prostitution. Because of its illegality, the exchange of child pornography on the Internet often takes the form of e-mail exchanges and newsgroups rather than the creation of websites, making it a more difficult subject to research.[2]

[1] For example, Castells (1996, page 344) notes that erotic chat accounted for a significant portion of France's Minitel system during the early 1990s. Additionally, the rise of AOL as the number one Internet service provider was assisted by its chat rooms in which messages were uncensored and private rooms were available. Prodigy and CompuServe did not allow adult-oriented chat in part because their parent companies Sears/IBM and H&R Block were worried about having their reputations sullied through association with online sex (Thompson, 2000).

[2] Although examples of Internet-based child pornography rings do exist (Kuitenbrouwer, 1996; Marquis, 2001; Stewart, 1997) it is difficult to determine what percentage of online pornography is of this nature. For example, Guttman (1999) reports that research found that 0.07% of 40 000 Internet newsgroups worldwide are oriented towards child pornography. This figure, however, does not include any estimate of the popularity or traffic in these groups. Guttman (1999) also cites Parry Aftab the former director of Cyberangels as estimating that there were 30 000 websites relating to pedophilia and/or child abuse. Furthermore, both for emotional and practical reasons, research on child pornography is not something that one enters into lightly. For example,

Digital products and ubiquitous demand

In many ways the adult industry is ideally suited for the Internet. On the supply side, the industry is greatly aided by the digital nature of its products which can easily bypass logistical and regulatory barriers that affect other types of electronic commerce. Furthermore, there are few barriers to the creation and maintenance of simple adult websites, making it relatively easy for individuals in any location to reach the majority of Internet users. Finally, the Internet adult industry provides a profitable linkage between areas with high poverty and few prospects, that is, Castells's "black holes", to global consumer markets. This linkage often takes place via the use of lower paid models but also includes the creation of websites. Although the Internet adult industry is likely not what many people envision when they seek to 'wire' their communities, connectivity provides the opportunity for both participatory and exploitative connections to global markets.

On the demand side, the anonymity of the Internet provides an easy avenue to pornography in localities that have outlawed or heavily regulate it and allows people to avoid the potential social stigma of visiting an adult bookstore. The global reach of the Internet provides a large potential market for any adult website regardless of the number of consumers in their immediate neighborhood. The large number of websites and other individuals interested in a particularly subject or fetish provides individuals with a perception of normalcy no matter what the judgment of their local society. Although this can be a boon for members of traditionally oppressed minorities (for example, gays and lesbians) the ability to find like-minded individuals also serves to validate the interests of pedophiles (Guttman, 1999; Marquis, 2001).

The demand for adult websites is difficult to pin down, although indicators suggest that a sizable portion of Internet users visits these sites. Netvalue.com reports that between 28% and 39% of Internet users, depending on the country, accessed an adult website during the month of January 2001.[3] Visitors to these sites are disproportionately young and male even when controlling for the makeup of the Internet population.

Value chains of a furtive industry

Although standard economic data sources such as county business patterns provide no data on the Internet adult industry, it is possible to outline a general schematic of the industry based on secondary sources (Franson, 1998; Glidewell, 2000; Lane, 2000; Perdue, 2001; Rose, 1997; Rosoff, 1999) as well as materials posted on resource sites for would-be adult webmasters.[4] Three geographically relevant and measurable manifestations include: (1) the production of content for the industry; (2) the creation and maintenance of websites to distribute content; and (3) the hosting of websites. These activities are easily separated (both organizationally and geographically) from one another and help to create an industry consisting largely of small firms but with a few dominant players.

Content creation

Although the Internet makes it possible for anyone to create and distribute adult content it appears that a relatively small number of suppliers provide the bulk of the

[2] continued
Larry C Matthews Jr is a journalist who was arrested and charged for trafficking in child pornography in 1996. He contended that he was conducting research on Internet pedophilia and the lack of police enforcement but was sentenced to 18 months in prison (Shepard, 1999).

[3] Netvalue figures are based on tracking the surfing habits of a panel of Internet users. See http://www.netvalue.com/ for more information.

[4] Sites consulted include the Adult Chamber of Commerce http://www.adultchamber.com, YNOTmasters http://www.ynotmasters.com, Hosts4Porn http://www.hosts4porn.com/articles, and the Adult Webmaster School http://www.adultwebmasterschool.com.

material to websites. Klein (1998, page 17) notes that creating original content is "Relatively easy to do ... [but] relatively hard to do well." Estimates suggest that "... 90 percent of free porn sites, and nearly all pay porn sites, buy their material rather than create it themselves" (Rosoff, 1999). This is particularly true for video streaming and live interaction that requires expensive equipment and facilities. Much of the video and interactive offerings are reportedly generated from a relatively small number of locations and then licensed to other sites (Rose, 1997). Obtaining content for the websites is likely the least expensive component of operating an adult website. Franson (1998) suggests that the cost for a website's content is less than 5% of its total cost.

Websites—free and membership

The main distinction between adult websites on the Internet is between free or feeder sites and membership sites. Membership sites offer affiliate programs to free sites that pay for surfers sent to the membership site and who sign up for a membership. Rosoff (1999) reports that, according to the "... YNOT Adult Network, free sites comprise between 70 and 80 percent of the adult material out there. These sites are used as 'bait' for pay sites and make their money by successfully guiding viewers to premium services on other sites." Free Internet adult sites have become increasingly prevalent over time (Shreve, 2001) and offer free pictures amidst a maze of banners and pop-up windows that direct visitors to membership sites. These sites are relatively easy to establish. Franson (1998) estimates that a few thousand dollars (and in some cases much less) is all that is required to start one up. This low barrier to entry has allowed many individuals and small firms to participate actively in the industry.

Although it is difficult to find direct evidence, it is likely that first-mover advantage was important in establishing the leading membership sites within the Internet adult industry. For example, one of the first firms to concentrate seriously on the Internet adult market was the Internet Entertainment Group (IEG) that grew from a startup to one of the largest adult companies on the Internet. The IEG was also an early innovator in providing live video feeds and by 1997 had contracted with 300 other sites to run live video feeds for a split of the profits (Rose, 1997). Another trend is users' increasing expectations for more content at lower membership prices. Lane (2000, page 142) reports that membership sites that used to charge US $24.95 have dropped their prices to US $9.95 or US $4.95 a month while offering a greater variety of content.[5]

Hosting

The final component of the Internet adult industry is the location of the computer upon which the site is actually hosted. Because of large bandwidth requirements, companies specializing in the adult industry rather than traditional hosting services generally host adult websites. Hosting options range from free sites that come with a high degree of advertising to starter packages that offer shared hosting for US $50 to US $100 dollars a month. Traffic to adult websites can build quickly, however, and is generally the most significant cost to websites. Rosoff (1999) points out that "A couple thousand users grabbing one or two high-quality images adds up to at least two gigabytes per month."

[5] In order to process the payment for memberships, adult Internet websites rely upon ancillary services to provide credit card processing. This is also an ongoing problem because of the high rate of disputed charges for Internet adult sites. Estimates on the charge backs from adult sites vary from 1.5% to 50% depending on the source. This compares to 0.2% for all merchants and a generally accepted threshold of 1% charge backs before the merchant account is closed (Fargo, 2000). As a result, Internet adult websites regularly pay higher processing rates to credit card companies and sometimes cannot set up merchant accounts at all (Hisey, 2000). High-volume offline merchants pay 1.5% on credit card charges, web merchants pay 2.5%, and online adult sites pay 3.5% to 4.5% and when all fees are included they can be paying up to 7% (Fargo, 2000; Hisey, 2000).

Growth on the margins of the net

Even with a sense of its overall structure, it is extremely difficult to obtain accurate figures on the size and revenues of the adult industry either offline or online. Recent estimates on the size of the entire adult industry in the United States range from a high of US $10 billion to US $14 billion dollars reported by Rich (2001) to a low of US $2.6 billion to US $3.9 billion estimated by Ackman (2001). Obtaining reliable counts of Internet adult websites is likewise a difficult undertaking. According to a report in *American Demographics Magazine* cited by Frammolino and Huffstutter (2001), E-commerce sex websites grew from 230 in 1997 to 1100 sites in 2000, and the number of web sites offering free sex content jumped from more than 22 000 to nearly 280 300 during the same period. Others estimate that there were 20 000 to 40 000 adult sites in 1998 (Franson, 1998; Morais et al, 1999; Rose, 1997) and a recent estimate placed the number of sites at 500 000 (Carr, 2000).

A more systematic estimate is made by comparing the number of web pages returned for keyword searches from popular search engines. Table 1 illustrates that the overall number of sites indexed under the keywords 'sex' and 'porn' runs into the millions, but these figures are significantly smaller than the number of sites returned for a number of other popular keywords ranging from 'news' to 'shopping'.(6)

Although the number of websites indexed by different search engines varies, the relative returns for keywords provide an estimate of the percentage of websites that contain adult material. Because keyword searches capture all pages that contain a particular word regardless of content, for example, some pages indexed under these keywords are actually antiporn sites, these figures are best interpreted as the upper limit of the size of a particular type of content. Table 1 demonstrates that pornographic

Table 1. Results of keyword searches on selected search engines [source: author survey on 1 September 2001; totals for the number of web pages indexed by a search engine based on Sullivan (2001)].

Keywords	Indexed web pages (millions)							
	Google		AltaVista		Lycos		Northern Light	
	no.	%	no.	%	no.	%	no.	%
News	129.0	9.3	158.3	28.8	63.0	10.1	109.7	31.3
Health	54.2	3.9	40.4	7.3	27.8	4.4	22.5	6.4
Music	50.9	3.7	50.3	9.1	26.0	4.2	17.6	5.0
Sports	39.7	2.9	43.4	7.9	24.9	4.0	24.6	7.0
Travel	35.3	2.5	40.0	7.3	22.8	3.6	16.0	4.6
Games	33.2	2.4	29.0	5.3	19.1	3.1	20.8	5.9
Shopping	30.1	2.2	78.7	14.3	22.3	3.6	13.4	3.8
Jobs	25.6	1.8	16.1	2.9	13.3	2.1	20.8	5.9
Weather	21.5	1.6	21.8	4.0	16.3	2.6	11.3	3.2
Sex	21.0	1.5	13.9	2.5	11.7	1.9	4.9	1.4
Porn	6.3	0.5	3.1	0.6	3.7	0.6	2.9	0.8
Gambling	2.5	0.2	1.5	0.3	1.1	0.2	0.9	0.3
Total web pages indexed	1 387		550		625		350	

(6) Given the pioneering role of adult Internet websites it is likely that the percentage of pornographic websites in 1995 and 1996 was significantly higher than in 2001. However, reliable estimates on this have not been found.

oriented websites likely account for less than 0.8% of Internet websites.[7] This figure is lower although in line with the 1.5% figure reported by Lawrence and Giles (1999) in February 1999.

Obtaining reliable figures on the revenue from these sites is also difficult. Forrester Consulting estimates that adult Internet services brought in US $50 million dollars in 1996, approximately 10% of all Internet retail, and between US $750 million and US $1 billion in 1998 (Branwyn, 1999; *The Economist* 1998). Datamonitor estimates that US $1.4 billion was spent in 1998 and predicts US $1.78 billion in 2000 and US $2.3 billion in 2001 (Carr, 2000). Although all these figures should be treated with some skepticism they do indicate a sizeable industry.

Additionally, the industry remains important to the Internet because of its consumption of bandwidth.[8] Perdue (2001) observes,

> "Bandwidth revenues are significant because, while there are trillions of HTML web pages in the Web universe, most are non-adult text pages with small graphics. On the other hand, even relatively small porn images are rarely less than 100 K and most are substantially larger."

For example, many of the most commonly visited sites such as Hotmail, Google, and Yahoo!, have download requirements ranging from 9 to 30 kilobytes. The entry page for popular adult websites such as Cybererotica, Karasxxx, and Persiankitty, however, had significantly higher bandwidth requirements extending from 221 to 556 kilobytes. Although the exact amount of Internet bandwidth consumed by the adult industry is impossible to measure, Perdue (2001) estimates that the industry pays approximately US $1.9 billion in bandwidth charges a year.

The leading edge of diffusion

Because the United States was the original location of the Internet, the diffusion from it is a good indicator of how quickly an Internet activity is dispersing to the rest of the world. Table 2 shows the percentage of the top 100 websites for seven different categories located in the United States over time.

One of the key observations from this table is that the category most likely to involve the shipment of a physical item (shopping) remained the most highly concentrated in the United States where the largest number of Internet users and shoppers were located. Other types of sites such as news or sports were more dispersed but did not change that much over time. In contrast, adult and gambling sites were the most highly dispersed activities on the Internet and exhibit a steady diffusion from the United States.

Measuring the adult industry's space of flows

The complexity and volatility of the Internet adult industry make obtaining reliable data on it difficult. The added complication of cyberspace makes research even more challenging. It is possible, however, to leverage geographically meaningful data based

[7] This finding stands in stark contrast to *Time Magazine*'s July 1995 coverage that suggested that more than 85% of the websites on the Internet were pornographic (Elmer-DeWitt, 1995). Although the study on which *Time*'s report was based was seriously flawed (for example, rather than a study of Internet websites in general it examined adult-oriented Usenet groups (Chapman, 1995), it nevertheless provided a great deal of fuel for anti-Internet-pornography legislation passed by the US Congress.

[8] An additional aspect of the adult industry not addressed in this paper is its role as an early adopter of technology. This role predates the Internet and examples such as photography, cinema, video cassettes. Minitel, compact disk, pay per view, video on demand, video conferencing, search engine manipulation, banner ads, streaming technologies, web consoles, pop-up ads, and affiliate programs were all pioneered by the adult industry before becoming widely used elsewhere.

Table 2. Percentage of 100 most visited websites located in the United States [source: 1999 and 2000 data—Top Web site list supplied by Go2Net (http://www.100hot.com/) with location based on address of domain name; July 1997 data—Paltridge (1997) using the same methodology].

	July 1997	October 1999	January 2000	October 2000
All top sites	94	90	87	86
Shopping	86	97	93	94
Finance	75	85	87	89
News	67	66	65	72
Sports	70	79	77	75
Adult	79	68	64	58
Gambling	na	67	52	39

on domain names to construct a picture of this industry's geographic distribution.[9] The reader should exercise caution in extrapolating from the data and conclusions presented in this paper. Although the results of multiple datasets tell a similar story, they can vary a great deal in the particulars. Moreover, the level of turnover, particularly among free sites, means that this analysis does not present a definitive picture but simply identifies certain characteristics of the geography of the industry at a particular moment in time.

The first step in the process is the generation of a list of websites associated with the Internet adult industry. Rather than attempting to capture the complete population of websites, I use indexes and directories of adult sites that are readily identifiable and available on the Internet. Although the resulting database is much smaller than the estimated totals presented in table 1 it provides a reasonable sample of the websites that an average Internet user would likely encounter.

The majority of these data are from the summer of 2001 and are based on computer programs (web spiders) designed to collect all the links from a particular web-page index. The programs gather the full listing of web pages from an index but do not expand beyond the original site. Because there can be any number of links to the same domain (for example, http://www.domain.com/page1.htm and http://www.domain.com/page2.htm), the URLs were aggregated to unique domain names (for example, domain.com). This prevents any undue weight placed on the few domain names that contain a large number of web pages. In general, domains with multiple links do not indicate more than one website but are used to provide different feeds for traffic.

The location of the company or individual that registered the website is based on the information returned on a who-is query[10] as outlined elsewhere (Zook, 2000; 2001). Although there is no guarantee that the registration addresses for a domain name and the location of makers of the website is the same, it is argued (Zook, 2001) that there is a strong correlation between the two. The volatility and surreptitious nature of the Internet adult industry, however, provide cause for concern on the reliability of this connection. Therefore, considerable time was spent cleaning the data and eliminating

[9] Although the subject of this paper is the adult industry, the methodology used here could be successfully applied to many other industries on the web and the way in which they connect to specific places such as gambling (see Wilson, 2003).

[10] Who-is data for the com, net, and org top-level domains provide the location information for 95% of the sample. Domains under country code top-level domains (for example, .uk, .de, or. fr) are assumed to be located in the country to which the top-level domain corresponds, except in the cases where the top-level domain is known to exist separately from a country's Internet use. These country codes include Tuvalu (tv), Tongo (to), the Cocos Islands (cc), Western Samoa (ws), Christmas Island (cx), and Niue (nu). Domains under these country codes were excluded from the datasets.

Table 3. Sources of data.

Industry component	Date	Source	Links	Unique domain names
Content				
(1) Online—image or video production	May 2001	adultsiteowners.com webmasterslounge.com yahoo.com ynotwebmasters.com	760	534
(2) Offline—video production	May 2001	Adult Video News List avn.com	502[a]	502[a]
Websites				
(3A) Top membership sites	2000/ 2001	combined listings from PCData Online, Nielsen Netratings and Alexa.com[b]	125	125
(3B) Top membership sites	May 2001	sextracker.com (top sites)	8 056	3 311
(4A) Mid-level membership sites	June 2001	google.com (membership sites)	2 041	2 401
(4B) Mid-level membership sites	August 2001	sites listed on password-trading sites[c]	1 067	1 067
(5) Free, feeder, and age-verification sites	May 2001	google.com (nonmembership sites) sextracker.com (nonmembership sites) adultcheck.com	71 070	29 475
Hosting				
(6) Location of IP addresses of domain names[d]	August 2001	www.caida.org/tools/utilities/netgeo/	na	na

[a] Actual mailing addresses for companies in Adult Video News's directory.
[b] Adult-oriented sites were selected from Alexa's listing of the 1000 most visited websites for December 2000.
[c] Links came from approximately forty password-trading sites.
[d] IP addresses for domain names were obtained from a DNS lookup.

observations that included obviously inaccurate address information. Although this provides a higher degree of confidence that the geography described reflects the reality of the industry, I remain cautious in interpreting its results.

Based on the industry's value chain developed in this paper the data have been divided into content, websites, and hosting and are outlined in table 3 and described in more detail in the following section.

Content creation

A membership directory posted by the Adult Video News (AVN), an industry trade group for the adult industry, is used as an indicator of offline adult-content production. Because the AVN is primarily geared towards the production and sale of adult videos, this membership list is a good indicator of the distribution of content production for one of the major components of the offline adult industry. In order to generate a representative sample of content providers for Internet sites, links offered at four separate indexes were assembled. These links provide adult webmasters with easy access to the producers of all types of digital content including images, video, and audio. There was a high degree of duplication between the four sources although each contained unique links.

Websites—free and membership

Because the bulk of the Internet adult industry is websites, adult websites form the largest component of the dataset. In order to examine differences in the geography of membership and free sites, data representing both activities were gathered from a variety of sources. Membership sites are divided into top and mid-range categories to reflect that a few large websites receive a great deal of the traffic (Rosoff, 1999). Additionally to guard against bias in any one data source, duplicate measures were gathered for each category.

The first source for top membership sites is a combination of top sites identified by Nielsen Netratings and cited in Carr (2000), identified by PC Data and cited in Perdue (2001), and adult sites from Alexa.com's 1000 most visited sites identified by the author. Traffic-measuring services use very different proprietary methodology for their rankings and generally make listings only of the most visited sites available. Combining the listings from several different sources provides a more comprehensive sample of top sites. The second source for top membership sites is from Sextracker, a traffic-measuring services that concentrates specifically on adult websites.

Mid-range membership sites represent Internet adult sites whose revenue streams come from memberships but are not among the most visited sites. The first source of mid-range sites is based upon Google's listing of membership websites. The second source is based on the listings found on approximately forty 'free password' sites that post reputedly stolen passwords to adult websites. Although it is unclear whether these sites actually provide stolen passwords or are simply another way to channel Internet users to certain sites (Leonard, 1998), they offer a listing of websites that require membership passwords but are small enough plausibly not to recognize stolen passwords long enough for them to be useful. A comparison of the mid-range with the top membership sites shows relatively little overlap. The Google membership list of 2401 domains shares only 118 domains with the Sextracker listing and 12 domains with the combined top listings and the list of 1067 domains from the free password sites shares 44 and 15 domains with the top membership sites.

The final website category is by far the largest and represents the free and feeder websites that are the bulk of the adult sites on the Internet. This category is based on the combination of three different sources. The first comes from sites listed in the Google directory except for those that are membership sites. The second is based on web pages found in Sextracker's index that are not listed among the top websites. The third category is based on sites listed at AdultCheck.com, one of the largest age-verification services on the Internet.[11]

Hosting

The final component is the location of the actual computer (based on its IP address) upon which an adult website is hosted.[12] This paper uses the free service offered by Caida.org to geocode IPs. One of the limitations of this service is that the records are organized around blocks of IP numbers assigned to a single geographic location for a network provider. Because these blocks of IP numbers can be subdivided further and are not simply clustered at a single location, the geographic information returned on

[11] Adult verification services arose as an effort to limit access by minors to adult sites by providing access to a large number of adult websites through a common ID and password. However, the sites are very similar to free sites in their efforts to direct traffic to top membership sites and therefore are included in this category.

[12] The IP address is the unique numerical identification that computers on the Internet use to exchange data. Domain names provide a user-friendlier interface (www.karasxxx.com) to the numerical equivalent (208.185.230.222).

IP numbers must be interpreted with care (Moore et al, 2000). Because of this issue, the geography of IP numbers is examined only at the international level.

Globalization of an underground industry

The data available at the international level provide a look at the distribution of content production, membership websites, free websites, and hosting. Although the United States remains the largest concentration of Internet adult activity there are a number of countries that have emerged as important nodes in this particular space of flows.

Content creation and concentrating profits

The first component of the Internet adult industry is the distribution of adult content. Although it is likely that content creation is more dispersed than the indicators here suggest (*The Economist* 1998), the distributors of adult content appear to be concentrated in many of the principal centers of the Internet. For example, table 4 illustrates that almost 70% of the content distributors are based in the United States. The other countries listed in this top five include those with some of the highest user rates on the Internet. Canada and Australia are interesting cases because they have much larger concentrations of Internet adult-content distributors than their regular presence on the Internet (as measured by their share of registered domain names) suggests. In contrast, the United Kingdom, the country with the largest Internet presence after the United States, has a relatively low level of Internet adult-content distributors.

The bulk of money spent an content appears to go to the photographers and distributors rather than the models themselves; a trend which has intensified over time. In 1994, models in the United States for online interactive adult video received approximately US $50 an hour but by 1997 wages had dropped to US $15 to US $20 an hour or about a twentieth of the revenues that the video stream could generate (Lane, 2000, page 247). Other data sources available on wages within the adult industry (Richard, 2001; *The Economist* 1998) support these figures and Lane (2000) cites hourly wages for telephone sex workers at US $8 to US $15 an hour.

An important factor driving wages down is the structure of industry's space of flows which connects models from poorer regions of the world willing to accept lower wages with content distributors. As *The Economist* (1998, page 21) reports

> "Most West European producers of sex videos use East European actors wherever possible .... In only eight years, Budapest has become probably the biggest centre for pornography production in Europe, eclipsing rivals such as Amsterdam and Copenhagen. Stars' fees have dropped sharply. Even excruciating or humiliating acts usually cost the producer only two or three hundred dollars, roughly a third of the fees paid ten years ago."

Table 4. Distribution of online distributors of Internet adult content and countries' shares of all domain names (source: see table 3; data on domains include com/net/org and country codes and are from January 2001).

Country	Adult content	All domain names
United States	69.8	42.3
Canada	9.0	3.5
Netherlands	2.9	2.4
Australia	2.8	1.3
United Kingdom	2.2	12.4
Rest of the World	13.3	38.1

Morais et al (1999) echoes this assessment and list Thailand and Hungary as important new centers for the creation of pornographic materials. Much as information technologies have facilitated the creation of call centers of back-office functions in hinterlands, the Internet has provided the adult industry with easy access to lower wage locations. Even real-time interaction via chat and video streaming can now be arranged for relatively low cost.

Although a few models have been able to leverage the Internet to transition from model to web entrepreneur (for example, Danni Ashe of Danni's Hard Drive), these linkages suggest the exploitation of sex workers continues and has expanded in the Internet era. The dominance by the United States and the other countries listed in table 4 indicates that, although the production of content may be more dispersed, the distribution systems and likely a high proportion of the profits remain in the hands of economic actors located in the most developed countries.

Membership websites

The next component in the Internet adult industry is top membership sites.[13] These sites experience the most traffic and are the source of income that fuels free sites and pays for the bandwidth consumed by the transfer of adult materials. For that reason these websites offer more and a greater variety of content which requires greater sophistication to operate. Table 5 reveals that the largest concentrations of

Table 5. Global distribution of top Internet adult websites (source: see table 3).

Country	Top sites—combined listing—3A		Top sites—Sextracker—3B		
	% of total	DN ratio[a]	% of total	DN ratio[a]	concentration
United States	60.8	1.4	51.5	1.2	1.6
Canada	5.6	1.6	9.8	2.8	5.0
Netherlands	5.6	2.3	2.6	1.1	4.7
United Kingdom	3.2	0.3	1.9	0.1	8.1
Australia	2.4	1.8	1.9	1.4	4.8
Israel	2.4	8.5	1.4	4.8	15.6
Antigua and Barbuda	2.4	44.4	1.0	17.9	43.8
Germany	1.6	0.2	1.8	0.2	3.4
France	1.6	0.8	1.0	0.5	9.1
Spain	0.8	0.7	1.1	1.0	17.1
Subtotal	86.4		73.8		
Countries with mixed results from the two data sources					
Saint Kitts and Nevis	3.2	320.0	0.1	6.0	50.0
Turks and Caicos Islands	1.6	14.3	0.0	0.0	-
Bulgaria	0.0	0.0	2.3	114.8	60.5
Russia	0.0	0.0	2.2	9.0	5.6
Denmark	0.0	0.0	1.6	1.8	3.7
Total	91.2		79.9		

[a] Domain name ratio.

[13] In the interest of saving space the analysis on the global distribution of mid-range membership sites is not presented here. In large part this mirrors the findings of table 5 with a few countries such as Russia, Denmark, and Sweden entering the top ten countries. However, the trend towards high involvement on the part of Eastern European countries continues as well as smaller pockets such as Gibraltar, the Bahamas, and the Netherlands Antilles.

top membership websites are located in countries that have the some of the largest Internet presences (Zook, 2001).

The number of websites alone, however, does not tell the entire story because countries that actively use the Internet will have larger shares of all types of Internet activity. To control for this, table 5 standardizes a country's presence in the Internet adult industry with the number of domain names registered in a country. This measure, the domain name ratio, divides a country's share of adult sites by its share of all domains (gTLD and ccTLD) worldwide in January 2001. A value greater than 1.0 indicates that the country has a stronger presence in the Internet adult industry than on the Internet in general.

This measure shows that the United Kingdom, Germany, France, and Spain all have a relatively small number of top membership sites compared with their overall presence whereas other countries such as the United States, Canada, the Netherlands, Denmark, and Australia have a specialization in adult sites. This finding mirrors the location of content distribution. A few locations such as Israel, Antigua, Saint Kitts, the Turks and Caicos Islands, Bulgaria, and Russia, however, show much stronger presences in the adult industry than on the Internet in general.

Again this specialization tells only part of the story because a small number of adult domains run by a single individual could greatly bias this measure. Therefore, table 5 includes a measure of the diversity of the websites in a country. This concentration index compares the largest single holder of adult domain names to the total number of adult domain names in the country. For example, in Canada the largest single holder of adult domains names represents only 5% of all of Canadian adult domain names. This measure can also be used to remove locations from consideration where a single owner controls the majority of domain names.

The concentration index reveals that in the case of some locations the specialization in top membership sites is not necessarily evidence of a cluster of activity but is the result of a relatively small number of people. For example, the majority of websites located in Bulgaria and Saint Kitts are owned by a single organization casting doubt as to whether this is indicative of a larger trend. It is possible that these places with high domain name ratios and high concentration indices are locations of convenience much in the same way that offshore financial centers provide a regulation-free space for many financial transactions (Roberts, 1994). Other countries, however, with high domain name ratios, such as Israel and Russia, show levels of diversity that are comparable with the larger hubs in this system.

This suggests that, although the geography of Internet adult sites corresponds with other uses of the Internet (for example, the United States is the largest user of the Internet in general and is the largest location of the Internet adult industry), an alternative cybergeography is emerging with Eastern Europe and the Caribbean playing important roles. In addition to the countries listed in table 5 there are a number of other nations (largely concentrated in Eastern Europe) whose domain name ratio for the Sextracker list of top websites is relatively high.[14]

Free websites

The next step is the examination of the geography of free Internet adult websites. Table 6 illustrates a similar distribution of websites among the top five countries as

[14] These countries and their domain name ratios include Belize (27.2), Estonia (26.4), Belarus (25.9), Latvia (8.6), Yugoslavia (8.3), Ukraine (5.1), Romania (3.4), Poland (2.9), Philippines (2.2), Czech Republic (2), Slovakia (1.7), Portugal (1.6), Thailand (1.6), Greece (1.5), and Sweden (1.5). They are not included in table 5 because they did not appear in the combined listings dataset (3A) and had less than 1% of the domains in the Sextracker dataset (3B)

Table 6. Largest national concentrations of free Internet adult websites (source: see table 3).

Country	% of total	Domain name ratio	Concentration
United States	57.0	1.3	2.5
Canada	10.2	2.9	6.3
United Kingdom	4.8	0.4	22.0
Australia	4.8	3.6	13.4
Netherlands	2.9	1.2	8.3
Antigua and Barbuda	2.0	37.4	25.6
Germany	1.3	0.1	7.9
Sweden	1.1	1.7	9.8
Denmark	1.0	1.2	17.1
Russia	0.9	3.7	10.0
Total	86.0		

Table 7. Most specialized countries of free Internet adult websites (source: see table 3).

Country	% of total	Domain name ratio	Concentration
Antigua and Barbuda	2.0	37.4	25.6
Virgin Islands (British)	0.3	10.6	43.2
Bulgaria	0.2	9.2	34.1
Belize	0.1	6.3	33.3
Bahamas	0.2	5.6	23.2
Panama	0.1	4.7	17.1
Estonia	0.1	4.2	12.5
Russian Federation	0.9	3.7	10.0
Australia	4.8	3.6	13.4
Netherlands Antilles	0.1	3.3	46.7

with top membership websites and content distribution. Antigua remains an important location with a concentration measure roughly equivalent to the United Kingdom or Denmark. Russia and Australia also emerge as significant locations with significantly higher presences in the Internet adult industry than other activities.

The larger sample size of free sites provides an opportunity for a closer look at smaller nodes as well. As the example of Antigua and Russia suggests, the data show a tendency for locations with more modest Internet activity to join the global Internet via the adult industry. Table 7 presents the ten countries with the highest domain name ratios for free Internet adult sites.[15] With the exception of Australia, these countries are located in Eastern Europe or the Caribbean. Although their total share of free sites is small compared with nations such as Canada or the United Kingdom, these countries clearly have stronger connections to the Internet adult industry relative to the Internet in general.

Web hosting

The final component of the international geography of Internet adult industry is the location of the computers that host these websites. The digital nature of the industry's product makes it extremely easy for webmasters to host their websites anywhere and

[15] Countries with fewer than 10 identified websites or with concentration index greater than 50 were excluded from this table. Countries excluded for lack of diversity include Bangladesh (27.6), Saint Kitts and Nevis (17.2), Gibraltar (14), Namibia (13.8), and Yugoslavia (8.1). The figure in parentheses is the country's domain name ratio.

given the industry's general interest in avoiding oversight and possible prosecution it is possible that some people seek a degree of protection from legal problems by placing their products in hospitable regulatory environments. Corporations have long sought and used offshore tax havens, but the Internet has made this kind of regulatory arbitrage much easier for a wider group of individuals and companies (Pachner, 1999; Taggart, 2000).

The analysis based on the location of IP addresses associated with adult websites, however, shows that shifts in the location of hosting are not taking place to any great extent. As table 8 indicates, the vast majority of adult websites are hosted on computers located within the United States and is considerably higher than the hosting patterns of more mainstream activities (represented by the distribution of gTLD domains). Nevertheless, table 8 shows that some countries such as the Czech Republic, Antigua, Russia, and Bulgaria provide hosting for relatively more adult websites than mainstream Internet sites. This supports the idea that these countries are emerging as nodes in the Internet adult industry.

This high concentration of hosting in the United States reflects the fact that much of the traffic on the Internet is routed through the United States (Cukier, 1999; TeleGeography, 2001; Townsend, 2001b). Although this has decreased over time, the US Internet infrastructure is highly accessible to the rest of the world and is extremely competitively priced. Therefore, although adult webmasters may express concern over the attitudes of US policymakers and law enforcement towards Internet pornography, it does not appear to have manifested in their hosting-location decisions. Rather the advantages and speed offered by the robust infrastructure of the Internet in the United States serve to retain adult hosting and attract the business of foreign-based webmasters. This contrasts significantly with the Internet gambling industry which appears to be much more sensitive to the regulatory environment in the USA. An examination of the geography of IP addresses associated with the gambling sites identified by Wilson (2003) shows that only about 54% of the world's gambling sites are hosted on a computer with an IP address located in the United States. Interestingly, another 26% are hosted in Canada which offers a similarly robust infrastructure but is conveniently under a different regulatory regime.

Regulatory push and opportunistic pull

Although there are a number of reasons for this distribution of Internet adult industry, two factors—regulation and low barriers to entry—have likely played leading roles in

Table 8. Top countries for Internet hosting, percentage of total (source: see table 3).

Country	All membership sites	Feeder sites	gTLD domains[a]
United States	85.0	93.3	64.6
Canada	7.6	2.2	4.6
Netherlands	1.5	0.9	1.5
France	1.4	0.6	2.0
United Kingdom	0.5	1.0	5.3
Czech Republic	0.5	0.2	0.04
Denmark	0.4	0.1	0.4
Antigua and Barbuda	0.4		0.02
Russian Federation	0.4	0.4	0.1
Bulgaria	0.4		

[a] Because ccTLD domains (for example, .uk or .de) are not included in this measure it likely overestimates the level of hosting taking place in the United States and underestimates hosting in other countries that make extensive use of these TLDs.

shaping this geography. These factors offer a combination of push-and-pull incentives for the diffusion of the Internet adult industry out of the major hubs of the Internet and into more periphery nodes. The effect of regulation is seen most strongly in the case of Internet gambling where there are relatively clear-cut laws prohibiting Internet gambling sites in the United States and as a result is the most diffused Internet activity (see table 2). Although the Internet adult industry is also shaped by the regulatory regime of the United States, the prohibitions are not as clear-cut as in the case of gambling. For example, the Communications Decency Act passed in 1996 and the Child Online Protection Act passed in early 1999 have been found to be unconstitutional restrictions of free speech by federal courts.

Nonetheless, many of the most specialized locations in the Internet adult industry are tied to places that offers havens from governmental regulation. Of the ten countries listed in table 7, six of them, Antigua, the Virgin Islands, Belize, the Bahamas, Panama, and Russia, are regularly reviewed by the OECD's anti-money-laundering task force (OECD, 2000). These offshore locations were first integrated into global systems by offering secrecy and flexibility to those who needed it. These nodes, however, did not simply spring up over night and Roberts (1994, page 11) argues the offshore banking system is overlaid upon "older geographies of tax haven activity and present-day geographies of hot [illegal] money flows." The concentration of the Internet adult industry in these offshore sites shows how the preexisting characteristics and endowments of locations are continuously adapted to new opportunities.

In addition to the push of regulation, the pull of an online industry with low start-up costs and digital products provides economic opportunities for individuals in peripheral locations. Unlike many types of electronic commerce, it is relatively straightforward to set up an adult website although profitability is not guaranteed. Additionally, the use of Eastern European models reported by Morais et al (1999) and *The Economist* (1998) is increasing the number of people familiar with and active in the Internet adult industry. This combined with the lower costs than Western Europe provides an opportunity for people to connect to this global space of flows.

Seduction of the US heartland?

Although the push of regulation and the pull of low entry costs have connected many new places to Internet adult industry, it remains concentrated in the United States. These push-and-pull factors, however, work to diffuse adult websites to more peripheral regions within the USA rather than concentrate in major metropolitan centers as has been observed for more mainstream Internet activities (Zook, 2000; 2002).

Shifts in content production

During the 1970s the adult film industry concentrated in the San Fernando Valley in Southern California with smaller concentrations in New York and San Francisco (O'Toole, 1998). The evolution of technology from film to video to digital formats made the creation and distribution of adult content much easier and less expensive. As Holiday (1999, page 351) notes, "Less than 1 percent of new releases [of adult videos] are shot on film .... Anyone with $10,000 and a cheapo video camera is now a director and distributor." This diffusion appears to have increased with the advent of the commercial Internet. Table 9 (see over) shows that, whereas the top six metropolitan concentrations for offline video content account for close to 80% of the video industry, they account for only 46% of online content production.

The drop in the Los Angeles share of content provision accounts for the bulk of this reduction. Although this is colored by the agglomeration of the adult video industry in the Los Angeles region, a trend towards diffusion is supported by the

Table 9. The location of video content providers versus online content providers (source: see table 3).

	Offline video content providers	Online content providers
Los Angeles (CA)	56.0	23.2
New York (NY)	9.0	7.1
San Francisco Bay (CA)	5.3	2.4
San Diego (CA)	2.9	4.5
Seattle (WA)	2.7	4.7
Las Vegas (NV–AZ)	2.5	4.2
Total	78.3	46.1
Nonmetropolitan	0.6	7.6

decreases in New York's and the San Francisco Bay's share of content provision. The growth in the share of the next three metro areas, San Diego, Seattle, and Las Vegas, which have strong Internet presences in general (Zook, 2000), also suggests a pattern of diffusion. The best indicator, however, is the marked increase in content providers located outside any metropolitan area from 0.6% to 7.6%.

These figures are emblematic of the shift from the highly concentrated structure of the adult film industry to a more distributed system on the Internet. The technology of the Internet offers new opportunities for economic actors in peripheral locations. Although traditional centers such as Los Angeles remain important, their dominance has declined as more peripheral nodes have begun to participate.

Membership websites

The Los Angeles metropolitan region also leads in the next link in the Internet adult industry value chain, that is, membership sites. Its share of these sites, however, appears to be smaller than its role in content production. Tables 10 and 11 outline the top ten locations for top and mid-level membership sites in the United States. Although the two largest metropolitan areas, Los Angeles and New York, contain

Table 10. Ten largest regional clusters of top Internet adult websites (source: see table 3).

	Top sites—combined listing—3A		Top sites—Sextracker—3B		
	% of total	DN ratio[a]	% of total	DN ratio[a]	concentration
Los Angeles (CA)	23.3	2.2	14.0	1.3	3.9
New York (NY)	6.8	0.6	7.5	0.7	5.7
San Francisco Bay (CA)	6.8	0.9	4.5	0.6	8.2
Washington, DC	4.1	0.9	4.6	1.0	12.0
Miami (FL)	4.1	1.7	3.5	1.4	5.3
Seattle (WA)	9.6	4.2	2.3	1.0	31.6
New Orleans (LA)	2.7	8.0	3.2	9.5	52.8
Las Vegas (NV–AZ)	2.7	3.6	2.8	3.7	26.1
Tampa–St Petersburg (FL)	2.7	2.9	2.4	2.6	7.5
San Diego (CA)	2.7	1.3	2.4	1.2	5.1
Phoenix–Mesa (AZ)	4.1	2.6	1.7	1.1	7.1
Total	69.9		49.0		

[a] Domain name ratio.

Table 11. Largest regional concentrations of mid-level Internet adult sites (source: see table 3).

	Mid-level sites—4A			Mid-level sites—4B		
	% of total	DN ratio[a]	concentration	% of total	DN ratio[a]	concentration
Los Angeles (CA)	19.4	1.8	4.1	26.8	2.5	9.6
New York (NY)	7.5	0.7	4.0	10.3	0.9	5.8
Miami (FL)	5.6	2.3	9.7	4.3	1.8	13.6
Las Vegas (NV – AZ)	4.7	6.2	3.8	2.2	2.9	18.2
San Francisco Bay (CA)	4.4	0.6	8.2	4.5	0.6	8.7
Phoenix – Mesa (AZ)	4.1	2.6	17.6	2.2	1.4	54.5
San Diego (CA)	2.8	1.4	8.5	2.0	1.0	10.0
Washington, DC	2.8	0.6	12.8	3.4	0.7	11.8
Atlanta (GA)	2.5	1.1	12.2	2.6	1.2	23.1
Tampa – St Petersburg (FL)	2.3	2.4	7.9	2.4	2.5	25.0
Total	56.1			60.7		

[a] Domain name ratio.

the largest number of membership sites, there are a number of large cities such as Chicago, Philadelphia, and Detroit missing from this list. In part this may be due to lower level of Internet adoption in general within these cities (Zook, 2000) but this also reflects the particularities of the Internet adult industry. For example, Boston, which has an important and sizable concentration of domain names, is missing from these lists entirely whereas other areas such as New Orleans, Las Vegas, Tampa, and Phoenix have significant clusters.

The concentration in these secondary cities is even more pronounced when the domain name ratio is examined. With specialization scores consistently above those of the larger concentrations in New York and San Francisco Bay, these cities are overrepresented in top and mid-level membership sites when compared with their use of domain names in general. Some of this may be the undue influence of a few individuals, but the concentration scores for Las Vegas and Tampa and to a lesser degree Phoenix indicate that a number of actors within these regions are actively participating in the Internet adult industry.

This diffusion out of primary metropolitan areas is also seen, albeit at a lower overall number of sites, in table 12 (see over) which outlines the regions with the highest specialization ratios in mid-level sites.[(16)] Smaller concentrations such as Macon (Georgia), Utica (New York), Melbourne (Florida), and Gainesville (Florida) emerge although they have significantly less diversity. A number of these smaller regions, however, such as Orlando, Tampa, and Tucson have significantly higher specializations than the largest concentration of adult sites, Los Angeles, while retaining significant diversity of ownership.

In addition, a number of metropolitan regions with high penetration rates of domain names such as San Francisco Bay, Provo (Utah), and Austin (Texas) (Zook, 2000) do not appear in the listing of specialized regions. The San Francisco Bay has consistently been a leader in the adoption of the Internet but has a domain name ratio

[(16)] In order to reduce the effect of individuals, regions with a concentration index greater than 50 in both of the data sources were excluded from this table. Because of the small sample size of the Combined Listing (3A) of top sites this paper does not include a table of the most specialized concentrations of top sites. However, according to just the Sextracker data (3B), the most specialized regions with concentration indexes of less than 50 are New Orleans (9.5), Bloomington, IL (9.10), Lawrence, KS (8.1), Utica – Rome, NY (5.2), and State College, PA (5.1).

Table 12. Most specialized regional concentrations in mid-level Internet adult sites (source: see table 3).

	Mid-level sites—4A			Mid-level sites—4B		
	% of total	DN ratio[a]	concentration	% of total	DN ratio[a]	concentration
Macon (GA)	0.3	6.6	60.0			
Las Vegas (NV–AZ)	4.7	6.2	3.8	2.2	2.9	18.2
Utica-Rome (NY)	0.2	5.2	33.3			
New Orleans (LA)	1.8	5.1	55.2	1.0	2.9	20.0
Tucson (AZ)	1.0	3.9	17.6	1.4	5.3	42.9
Melbourne–Titusville (FL)	0.4	2.8	28.6	0.4	2.6	50.0
Tampa–St Petersburg (FL)	2.3	2.4	7.9	2.4	2.5	25.0
Gainesville (FL)	0.2	2.3	33.3	0.4	5.1	50.0
Orlando (FL)	1.5	2.1	12.5	1.4	2.0	28.6
Los Angeles (CA)	19.4	1.8	4.1	26.8	2.5	9.6

[a] Domain name ratio.

for all aspects of the Internet adult industry that indicates that it has less than its expected share of adult sites. Likewise, Provo, which has been an important region for software development and Internet activity, has a relative small presence in the online adult industry.

This suggests that the geography of the Internet adult industry is shaped by different factors than the use of the Internet in general. For example, the low barriers to entry in the Internet adult industry make the technological skills concentrated in the San Francisco Bay region less important. Similarly, stronger prohibitions against pornography and active enforcement of them may have made Utah a less desirable regulatory environment for adult webmasters (Mnookin, 2001).

Free websites

The final step in this analysis is the geography of free Internet adult websites. Although Los Angeles and New York top the list in table 13 it is at significantly lower percentages than in content production and membership sites. Because free adult sites do not require particularly high skill levels they are the easiest entrée into the Internet adult industry and have been widely adopted by people regardless of location. This is powerfully demonstrated in the case of Detroit which has the highest domain name ratio of

Table 13. Largest regional concentrations of free Internet adult websites (source: see table 3).

	% of total	Domain name ratio	Concentration	Sites per 100 000 people
Los Angeles (CA)	11.7	1.1	9.7	12.5
New York (NY)	4.4	0.4	2.9	3.6
Seattle (WA)	3.8	1.7	47.1	19.1
Detroit (MI)	3.7	2.7	55.3	11.5
San Francisco Bay (CA)	3.3	0.5	35.5	8.3
Miami (FL)	2.9	1.2	10.9	13.6
Washington, DC	2.8	0.6	17.3	6.5
Atlanta (GA)	2.5	1.2	46.0	11.8
San Diego (CA)	2.4	1.2	12.1	14.9
Portland (OR)	2.0	1.8	55.7	15.7
Total	39.5			

any of the top ten regions but does not have a strong presence on the Internet in general.

Although Detroit has a relatively high number of free adult websites compared with its total number of websites, it still has a smaller number of sites per capita than most of these top ten regions. This indicates that, although free adult sites constitute a larger proportion of the Detroit's web presence, it is still lower than other more wired regions. Likewise regions with the highest use of the Internet (for example, New York, San Francisco Bay, and Washington, DC), have the lowest number of free adult sites per capita indicating that the use of the Internet in these regions encompasses a much larger realm of activity than more peripheral locations.

Table 14 shows the extent of the diffusion of free websites.[17] In contrast to the specializations of top and mid-level membership sites none of the largest concentrations of free websites appears in the top fifteen most specialized regions. Rather, these metro areas are smaller and further down in the nation's urban hierarchy. Although their high scores in the domain name ratios are tied to relatively low adoption levels of the Internet, they also have comparable and often higher levels of sites per capita than the larger metro areas such as Los Angeles and Seattle.

Table 14. Most specialized regional concentrations in free Internet adult websites (source: see table 3).

	% of total	Domain name ratio	Concentration	Sites per 100 000 people
Saginaw – Bay City (MI)	0.8	14.4	32.8	31.7
Florence (AL)	0.2	9.6	31.8	16.2
Bloomington – Normal (IL)	0.2	5.4	20.0	21.6
New Orleans (LA)	1.2	3.5	17.6	15.2
Baton Rouge (LA)	0.4	3.1	12.9	12.3
State College (PA)	0.2	3.0	10.0	22.8
Scranton – Wilkes – Barre (PA)	0.2	2.3	19.4	5.7
Las Vegas (NV – AZ)	1.6	2.1	9.1	21.9
Tucson (AZ)	0.5	2.0	38.8	11.1
Albany (NY)	0.4	1.9	29.0	7.1
Anchorage (AK)	0.2	1.6	35.1	14.8
Pittsburgh (PA)	0.8	1.5	27.7	5.8
Orlando (FL)	1.0	1.5	17.2	11.9
Des Moines (IA)	0.2	1.3	26.9	6.1
Columbus (OH)	0.6	1.2	15.6	6.6

This review demonstrates that the geography of participation in the Internet adult industry varies considerably between the components of the industry and differs significantly from the use of the Internet in general. Although care should be exercised in declaring any one location an important node in the industry, the trend towards the diffusion of the production and distribution of adult content observed at the international level is repeated at the subnational level in the USA. Although the ties and advantages of history and agglomeration serve to concentrate some of it in central hubs such as Los Angeles, the component of the production chain that has the lowest barriers to entry—free and feeder sites—has diffused significantly to previously remote nodes.

[17] In order to reduce the effect of individuals, regions with a concentration index greater than 40 and with fewer than 25 websites were excluded from this table.

Role of local community standards

The geography of the US Internet adult industry reflects a similar pull-and-push dynamic identified at the international level. Low barriers of entry allow actors in more peripheral locations to connect and participate in this space of flows. In fact, this pull effect is so strong that some of the key Internet regions in the United States are actually 'underrepresented' in the Internet adult industry. Although the Internet adult industry is not likely what many people envisioned as the promise of the Internet, the high rankings of small cities reflects that it is one of the easiest commercial activities to join on the Internet.

Although federal laws apply to all US-based adult companies, local standards and enforcement have a significant impact on the location of the adult industry both online and offline. This is because one of the key legal decisions for the adult industry, *Miller v. California, 1973*, ruled that 'pornography' but not 'obscenity' was protected by the First Amendment. The distinction between the two is based on 'community standards' and has made for considerable differences between states and municipalities in the prosecution of the distributors of adult materials. For example, in 1994 the owners of the Amateur Action Computer Bulletin Board System based in California were charged in Tennessee after a postal inspector joined the site and was able to download pornographic material. A federal jury in Memphis found them guilty of obscenity and sentenced them to over 30 months in prison. The Seventh Circuit Court of Appeals rejected an appeal that their trial should have taken place where their business and computers were located and the Supreme Court refused to hear the trial.[18]

Although dramatic in its implications for the online adult industry, this case has been followed by others where the use of community standards has been less successful in obtaining convictions. In March 1999 a jury found the owner of an adult video store in Utah not guilty of obscenity because hotels in the area where showing the same movies via pay per view for which the store-owner was being prosecuted. More recently, courts have ruled that the production of adult-oriented websites may not impact on the community to the extent that they must conform to local regulations. In 2001 the 11th US Circuit Court of Appeals ruling found that the operation of a popular website called VoyuerDorm located in Tampa, Florida was not subject to local zoning ordinances because public participation took place via the Internet rather than in person (Shachtman, 2001).

Despite these rulings, localities and local standards remain a key variable in the regulation of the adult industry both online and offline. Recently Utah established the position of 'obscenity and pornography complaints ombudsman', commonly known as 'porn tsar' to determine what qualifies as pornography and pursue violators of this definition (Mnookin, 2001; *The Economist* 2001). Although a direct connection is difficult to establish, these efforts may contribute to the relatively low numbers of adult sites in Provo despite its otherwise strong Internet presence.

Placeless networks and local contexts

Although pornography is not a new phenomenon, its online incarnation has fundamentally changed its patterns of production, distribution, and consumption. Advances in technology have shifted pornography from adult bookstores to video rentals to the Internet, rendering it more accessible at every step. Currently pornographic material is readily available to anyone with a computer and unfiltered web connection and can be downloaded in complete anonymity. For the average web surfer, this cyberspace

[18] Interestingly, in 1992 the San Jose police seized the computers and decided not to prosecute the owners of the site (Lane, 2000, page 128).

connection is perceived as placeless, disconnected from any meaningful manifestation of geography (Dodge and Kitchen, 2001).

This geographic disengagement, however, is illusionary. The Internet adult industry operates in a complex space of flows which offers new methods for participation and exploitation. The nature of this interaction, the roles of particular regions, and the power relations within the industry depend upon the local attributes that undergrid this virtual connectivity. For example, the history of the Internet has served to imprint values strongly associated with the USA, particularly in regards to the fetishism of certain cultures and ethnicities while promoting Western views of sexuality. Moreover, content production in the adult industry has tended to disperse to lower wage locations, but the profits from this production are largely concentrated. At both the international and US level, the territoriality of legal regimes has pushed adult websites to openly hospitable regulatory environments or places with relatively weak government enforcement. At the same time the robustness of the US infrastructure makes it a preferred location for adult housing services. These examples aptly illustrate the continued importance and shaping role of location and places even within a 'perfect' Internet industry.

The assumption of easy access to pornographic content is likewise shaped by geography. Individuals in the United States and other countries with open Internet policies have unfettered access to adult websites, but only by using their own personal machines. Those whose Internet access is limited to cybercafes, workplaces, or public libraries are not guaranteed the same anonymous and unfiltered access. The public nature of cybercafes reintroduces the possibility of social stigmatization and may serve to restrict surfing habits. Companies often track and filter employees' web surfing at the workplace both to increase worker productivity and to guard against hostile workplace claims. Many public libraries and schools have installed filtering programs on computers in response either to federal regulations or to locally made decisions to restrict access to adult materials.

Beyond the issue of privileged access at the individual level are national policies to control the materials accessible on the Internet. Authoritarian governments face the dilemma of introducing their populations to the benefits and power of the Internet while at the same time suppressing subversive material. Although centered on issues of political speech, personal freedom, and human rights, adult websites generally appear on the list of undesirable materials. Zittrain and Edelman (2002a; 2002b) have documented the filtering efforts of China and Saudi Arabia which have explicit policies regarding Internet access. Although the structure of the Internet presents considerable technical challenges to such efforts, Zittrain and Edelman find that both countries succeed in blocking many websites critical of the government or promoting specific religious groups or social movements. Interestingly, the filtering efforts of China and Saudi Arabia diverged widely in blocking pornographic sites. Saudi Arabia blocked access to 86% of the adult sites tested whereas China blocked only 13%.

Despite such governmental efforts, the genie is out of the bottle and will be difficult to return, particularly in countries committed to personal liberties. The technology of the Internet has connected remote places and facilitated the diffusion of any number of economic activities such as call centers, off-shore banking, and data processing. The Internet adult industry is yet another example of how a combination of regulatory issues, lower costs for content, and low barriers to entry results in a restructuring of production and consumption. While allowing access to a whole new range of people, the Internet is still shaped by existing structures of regulation, power, and hegemony. In short, the 'space of flows' cannot be understood without reference to the 'space of places' to which it connects.

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