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internet diffusion
in the USA and China

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Based on surveys conducted twice a year between 1994 and 2000 by leading academic institutions in China and the USA, this study examines internet diffusion in the two countries by age, gender, occupation and educational attainment. It compares user demographics when the internet began and investigates whether they have changed in similar ways in the two countries. In the early development of the internet a similar user profile is indeed found ('young, male, with higher education background, from computer/education-related fields'), however, user demographics in the USA have since moved considerably closer to those of the general population. In China, on the other hand, things have changed more slowly. Though this might seem to imply that the diffusion of the internet into general populations is faster in developed than developing nations, similar data from other nations is needed to support this conclusion.

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The internet is perhaps the most powerful global communications medium that mankind has ever known. Yet it is not so much a new form of communications as a unique marriage of multiple functions and capabilities that have existed separately in different forms of traditional communications media. The internet combines elements of telecommunications, broadcasting and publishing into a new medium for communications.[1] Powered by rapidly advancing computing capabilities and tumbling digital communications costs, it has the potential to provide and support a full range of communication services, including information, entertainment and online commerce.

Many significant research questions have been raised by the rapid growth and expansion of the internet. One has been how the adoption and diffusion of this new technology differs across demographic groups within nations, and between the nations of the world. International studies have been made of the pervasiveness of the internet, its geographic dispersion, density within sectors, connectivity infrastructure, organizational infrastructure, and the sophistication with which it is used.[2] Numbers of computer hosts and internet users have been tracked to analyse the growth of the internet infrastructure.[3] Other research has focused on internet demographics in individual countries. A survey in Chile, for example, shows that the typical user there is 'young, male, highly educated, with a high income level'.[4] Yet studies in other countries point to 'substantial shifts of the characteristics of web users' in recent years.[5]

The relatively short history and fluidity of the internet have limited the scope of previous studies. In this paper, we seek to extend the traditional understanding of internet adoption and penetration from a single-country perspective to a cross-cultural analysis of adoption demographics over time that expands on previous studies. We look at four user demographics in the USA and China, including age, gender, occupation and educational attainment, and how each has evolved since 1994. We conclude by trying to extrapolate the results to other nations with similar economic and social characteristics. Because identifying and predicting internet use is politically important, we hope the findings of this study will be valuable to the academic community, government policymakers, business communities and individuals.

Background and research questions

The internet was born in a research program of the US Defense Advanced Research Projects Agency (DARPA) in 1973. In 1986, the US National Science Foundation (NSF) initiated the development of NSFnet, which laid the communications backbone for the internet.

1. M. Morris and C. Ogan, 'The internet as mass medium', *Journal of Communications*, Vol 46, No 1, 1996, pp 39–50.
2. S. Goodman, G. Burkhart, W. Foster, L. Press, Z. Tan and J. Woodard, *The Global Diffusion of the Internet Project: An Initial Inductive Study*, The MOSAIC Group, Fairfax, VA, March 1998; L. Press, G. Burkhart *et al*, 'An internet diffusion framework', *Communications of the ACM*, October 1998, pp 21–26.

Before its metamorphosis into a commercial tool between 1991 and 1994, almost all internet activities were confined to the research and education communities in the USA and Europe.[6] This was also to be the pattern in developing countries, which in recent years have seen a similar demographic distribution among internet pioneers. It is only after the internet is commercialized that user demographics within countries tend to diverge, with economic, social, technological and political factors usually determining the pace and the path.

It is clear that the longer history of internet usage within US academic and research communities has given it a stronger basis for growth and acceptance within the USA than would be expected within China. The internet first came to China via a connection established between China's Institute of High Energy Physics (IHEPnet) and Stanford University's research labs in the Bay area in 1991. This initial research linkage was eventually expanded to include many academic and research institutions with the establishment of CERNET (China Educational and Research Network). However, the commercialization and rapid expansion of internet access in China did not occur until 1995-1996, when multiple IT infrastructure programs and applications were introduced, in the Chinese government's 'Golden Projects'.[7] In January 1996 ChinaNET was successfully implemented: the first national, commercially available internet service across China. This was two years later than the introduction of commercial internet services in the USA, which is one of the reasons for selecting the 1994–1998 period to study the demographics of US internet diffusion, and the 1996–2000 period for the same analysis in China.

This study first explores the USA and China's start points: at the time of their launch, did their internets have a user base that reflected their economic and social make-up? Was the number of 'young, highly educated, computer/education-related males' disproportionate to their general population? Secondly, we examine how the pace and direction of internet adoption in the two countries has evolved since. Has the net succeeded in attracting older, female users, for example? Does its use still require a certain level of educational background, and are its users still largely college students and IT professionals?

Research methodology

Data sources

Data for the 1994-98 US study was collected through the 'WWW User Survey' conducted by the Graphic, Visualization & Usability Center (GVU) at the Georgia Institute of Technology.[8]

3. eg http://www.wizard.com.
4. M. Mendoza and J. Alvarez de Toledo, 'Demographics and behavior of the Chilean internet population', *Journal of Computer-Mediated Communication*, Vol 3, No 1, 1997.
5. C. Kehoe and J. Pitkow, 'Emerging trends in the WWW user population', *Communications of the ACM*, Vol 39, No 6, 1996.
6. V.A. Cerf, 'Brief history of the internet and related networks', at http://www.isoc.org/internet/history/cerf.html; R. Zakon, 'Hobbes' internet timeline v5.0', at http://www.isoc.org/guest/zakon/Internet/History/HIT.html.
7. Z. Tan, W. Foster and S. Goodman, 'China's unique internet infrastructure', *Communications of the ACM*, Vol 42, No 6, 1999, pp 44–52; T.H. Clark and J.J. Sviokla, 'China Internet Corporation (http://www.china.com)', Harvard Business School case #9-396-299, Boston, MA, 1996.

This remains the most authoritative bi-annual survey on internet demographics and usage in the USA by an academic institution. The data on the USA, the obvious global leader in the internet, should suggest a model for internet demographics in developed nations. The 1996 to 2000 data on China was collected through the 'Semi-Annual Survey on Internet Development in China', conducted by the China Internet Network Information Center (CNNIC).[9] CNNIC is China's authority on internet-related statistics and its official domain name registrar. Data from China, a late-comer but a significant future player on the internet, should illustrate whether developing nations are catching up on the internet and if so, how. Finally, it is hoped that wider international trends in internet diffusion can be inferred by comparing the two sets of data.

Data collection strategy

Results of both the surveys are in the public domain, and neither was commercially inspired. However, both were conducted online by linking questionnaires to popular websites and by announcing the URLs of the questionnaires through other mass media such as TV, radio and newspapers. Each GVU survey was conducted for one month. The CNNIC survey usually ran for half a month. After locating the URLs of the questionnaires, web surfers filled in online questionnaires.

The data collection method suffered from two potential problems. Firstly, the two surveys were based on non-random samples. The sampling population included only internet users who surfed the internet. Secondly, a self-selection process occurs when people choose whether or not to participate in surveys. Thus, caution is needed when applying results to the general population. However, since we are focusing specifically on internet users, and the most extensive users of the internet are likely to be respondents to both of these surveys, this was adjudged not to create any sampling bias.

The findings

Age distribution

GVU's January 1994 survey reported that 56% of the internet users in the USA were between 21 and 30 years old. Only 6% were younger than 21; 27% were between 31 and 40; 10% were between 41 and 50; and 2% were over 50. This result strongly suggests that the internet appealed first to a young population, aged between 21 and 30 in 1994.

GVU's October 1998 survey presented a very different age distribution among US internet users, with 5.7% younger than 21; 26% between 21 and 30; 24.7% between 31 and 40; 23.5% between 41 and 50; and 18.5% over 50. This almost evenly stretched distribution leads to the conclusion that the internet was fully diffused across the US population by 1998, with different age groups well represented, as shown overleaf in Figure 1.

CNNIC's October 1997 survey reported that 65% of Chinese internet users were between 21 and 30; 5% were younger than 21; 17% between 31 and 40; 7% between 41 and 50; and 5% over 50. The results are consistent with the findings from the USA, which leads to the conclusion that China's internet also appealed first to a young population, aged between 21 and 30 in 1997. The dominance was higher in China (65% in 1997) than in the USA (56% in 1994). CNNIC's January 2000 survey did not demonstrate an even user distribution among different age groups. Users between 21 and 30 retained a 51.3% dominance; 16.7% were younger than 21; 15.9% were between 31 and 40; 4.5% were between 41 and 50; and 1.6% were over 50. The result strongly supports the conclusion that China's internet is still dominated by young people. The expansion into an older population is moving more slowly, as shown in Figure 1.

The internet has been more rapidly diffused into different age groups in the USA than in China. One of the reasons for this is that fluency in English is more common among younger Chinese than among the general population in China. The increasing ability of the WWW

8. Graphic, Visualization & Usability Center (GVU) at the Georgia Institute of Technology, 'WWW User Survey 2000', at http://www.cc.gatech.edu/gvu/user_surveys/, 2000.

9. China Internet Network Information Center, Semi-Annual Survey on Internet Development in China, at http://www.cnnic.net.cn/develst_e/develst.htm, 2000.

and the internet in China to allow access entirely in Chinese to multiple useful URLs for entertainment, news, and commerce within China should help to increase the rate of diffusion in coming years. Even so, the dominance of English on the internet means it will continue to appeal more to young (and well-educated) members of Chinese society. This group is also more confident and adept with computers and the internet than its parents.

Figure 1: Age distribution among internet users in China and the USA.

Age distribution among Chinese users

Age distribution among US users
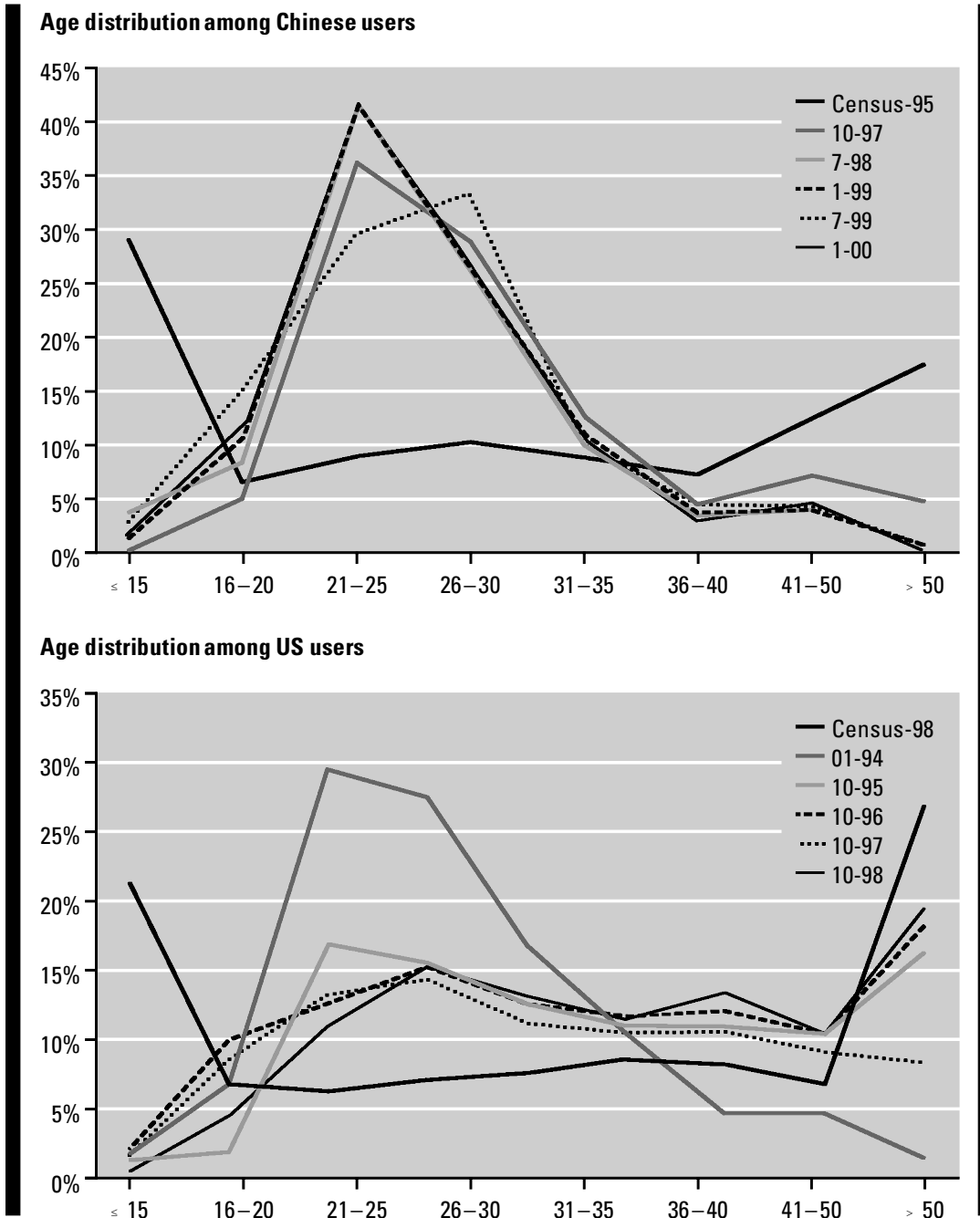
Gender distribution

The internet initially appealed to males in the USA, according to GVU's survey. The January 1994 survey indicated 95% of users were male and only 5% were female. However, this male domination had quickly decreased to 67/33% by October 1995. Today it has levelled to 60/40%, as shown overleaf in Figure 2.

The Chinese internet initially had 88% male users and 12% female (October 1997). The rapid growth in female users in the USA has not been matched in China: CNNIC's January 2000 survey reported 79/21%, suggesting that internet adoption among China's female population was growing only slowly. This is clearly demonstrated in Figure 2. This finding is somewhat surprising for China, since the Chinese government has long sponsored sex equality in the workplace and a shift to dual-career families. The low level of participation in the internet by Chinese females might simply be viewed as an issue associated with Chinese culture, where females are not strongly associated with high-tech applications.

In fact, this may be an area where survey bias might be a partial explanation of the reported differences between male and female users of the internet. It is possible that male users are simply more willing to surf into the survey site and complete the survey. Thus, self-selected sample bias in both cultures could lead to mistaken conclusions regarding gender bias. We should be careful about making too many generalized conclusions based on this single form of data collection. However, it is probably still safe to say that the internet in China remains more male-dominated than was the US internet at the same point in its development.

Educational attainment

Being able to use a computer is a prerequisite for internet society, especially in the early stages of its development. This is even more obvious in China, where to get online, basic English is as important as computer literacy. Both are directly correlated with education level, and generally inversely correlated with age. According to GVU's survey, the US internet was absolutely dominated by the highly educated in October 1994 (94% had at least some college education and 79% had a college degree). This education level has not changed significantly in the years since. In October 1998, 54% of US internet users had at least a college degree and 85% of US internet users had at least some college education. In contrast, across the general US population, 24% have a college degree and 46% have at least some college or post-secondary school education.[10] Thus, the level of education of internet users is significantly higher than that of the general population, with more than twice as many college graduates online as would be expected if internet users' education levels mirrored those of the US population.

Most of China's early internet users had higher education backgrounds as well. In January 1998, CNNIC's survey indicated that 59% of them had at least a college degree, 93% of more than two years' duration. This education level has changed only slightly over time. In the January 2000 survey, 52% of China's internet users had at least a college degree, 84% of two years or more. But the percentage of users with only a high school education or below has climbed from 7% in January 1998 to 16% in January 2000, as shown in Figure 3 on p602.

10. US Census Bureau, 1998 population statistics, at http://www.census.gov/.

China's census data indicates that at least 98% of people have only a high school education or less. The high percentage of Chinese internet users with higher education backgrounds supports the conclusion that they are a social elite. In contrast to the USA, where people with a college education are about twice as likely to be internet users as people without one, people with a college education in China are approximately 42 times (84% divided by less than 2%) more likely to be internet users than those without one. This is partially due to the English language and IT barrier for internet adoption today in China. Internet demographics are expected to shift closer to the distribution of the general population as Chinese language access and content increase in China.

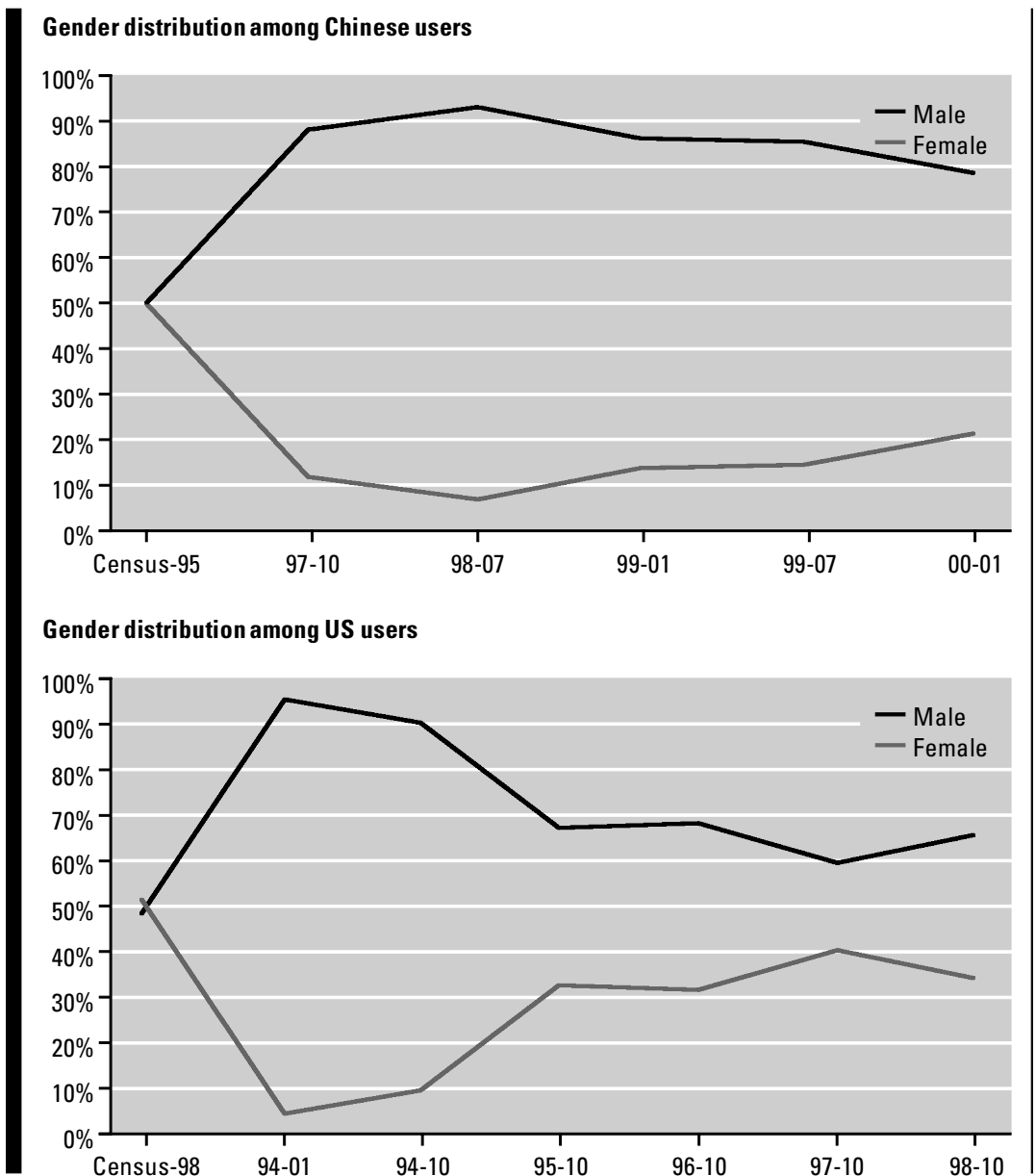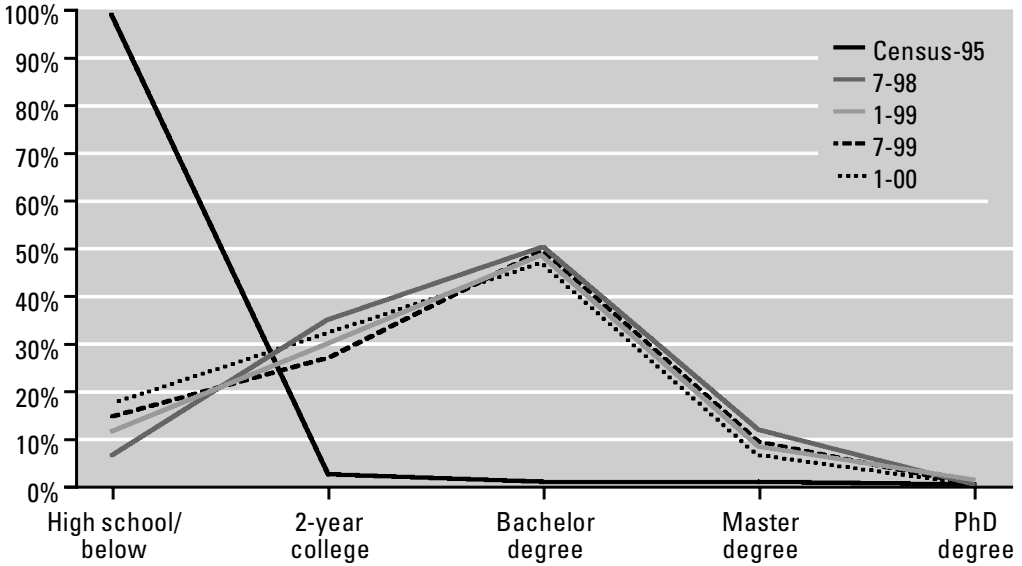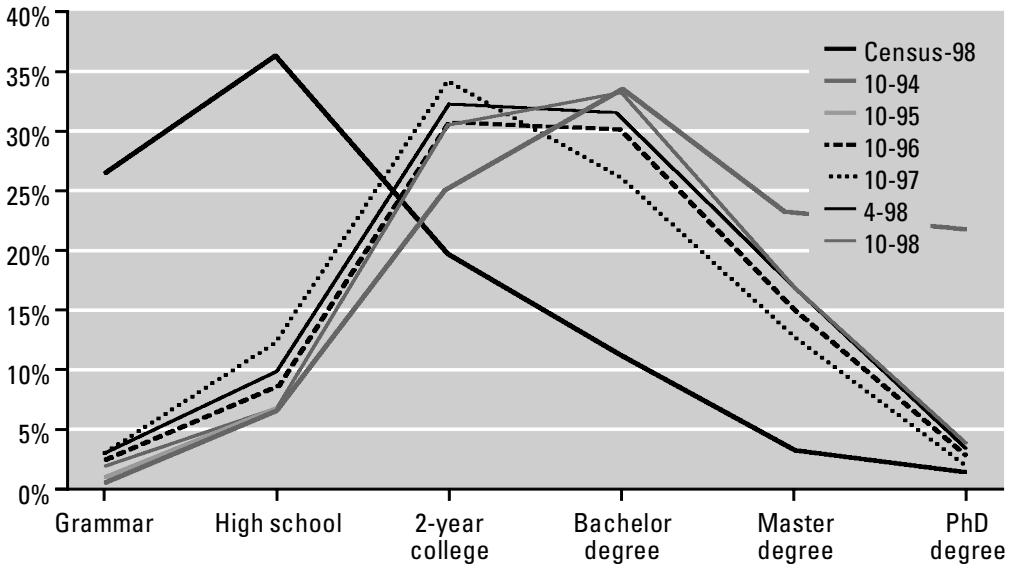**Figure 2:** Gender distribution among internet users in China and the USA.

Gender distribution among Chinese users

Gender distribution among US users

**Figure 3:** Educational attainment distribution among internet users in China and the USA.

Educational attainment among Chinese users

Legend: Census-95, 7-98, 1-99, 7-99, 1-00

X-axis: High school/below, 2-year college, Bachelor degree, Master degree, PhD degree

Educational attainment among US users

Legend: Census-98, 10-94, 10-95, 10-96, 10-97, 4-98, 10-98

X-axis: Grammar, High school, 2-year college, Bachelor degree, Master degree, PhD degree

User occupation

For computer professionals and people in the education and scientific fields, the internet has been an important tool – and sometimes toy – since its early days. In the USA, these groups accounted for 53% of internet users in GVU's April 1995 survey. By April 1998, this figure had slipped to 48%, showing a modest diffusion into other occupations, as shown overleaf in Figure 4.

China's internet also started in the education- and computer-related fields. CNNIC's survey revealed 61% of Chinese internet users were from these fields in July 1998. This domination has continued, with 55.1% of Chinese users being from education- and computer-related fields in January 2000, suggesting slow penetration among other occupations.

Figure 4: Occupation distribution among internet users in China and the USA.

Occupation distribution among Chinese users
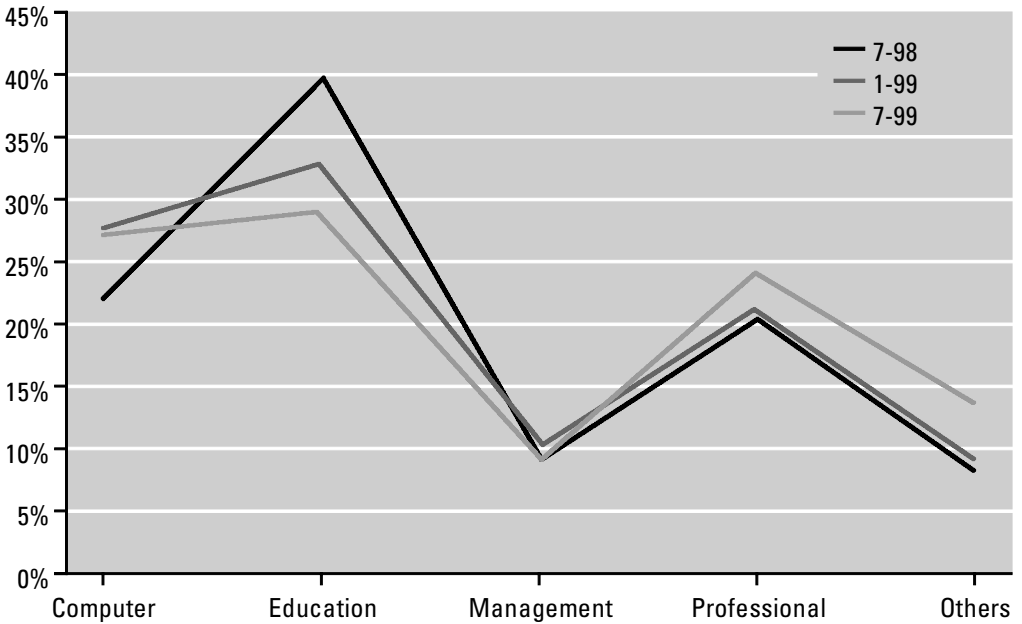
Occupation distribution among US users
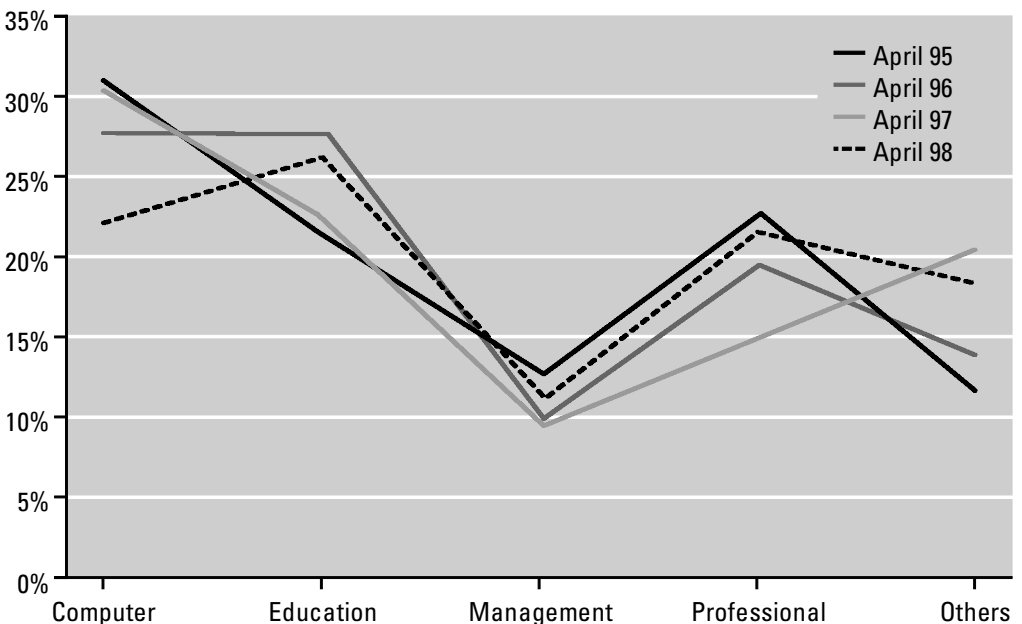
Conclusions

The internet started with a very similar demographic profile in the USA and China, which could be characterized as 'young, male, with higher education background, and from the computer- and education-related fields'. The profile of US internet users in 1994 was 56% between 21 and 30 years old, 95% male, 94% with at least some college education, and more than 53% from the computer and education fields. The profile of China's novice internet users in 1997 was 65% between 21 and 30 years old, 88% male, 93% with at least some college education, and 61% from the computer and education fields. Most of these characteristics are consistent with the survey results from Chile,[11] pointing to a similar initial user base for the internet worldwide. It is interesting to note, in fact, that there are more common demographic factors to US and Chinese internet users than might be expected, given the vast differences in national demographics in areas such as education and income.

However, the internet has taken different paces and paths to penetrate US and Chinese societies. This is mainly because of economic, political, social and technological differences between USA and China. The internet in the USA has expanded rapidly into different age groups in only four years, with internet users almost evenly distributed between the ages of 20 and 50. China's internet has penetrated other age groups much more slowly, with those between the ages of 20 and 30 retaining an absolute dominating position.

On the gender side, female users in the USA increased from 10% to more than 30% during 1994–95 (Figure 2). Since then, the 65/35% male predominance has remained relatively stable. In China, the internet has been much slower in attracting female users, and this lack of diffusion cannot be easily explained. Women still only make up 20% of users, although as mentioned earlier, it is possible that sample bias may overstate this discrepancy.

Both US and Chinese internet users are dominated by populations with higher education backgrounds. Given the lower percentage of the population with higher education degrees in China, the internet there remains disproportionately academic. US users from non-computer-related and non-education-related fields have increased dramatically, indicating the diffusion of the internet among other professions. China's internet is still dominated by users from the computer-related and education-related fields.

While the findings of this study might lead to the conclusion that diffusion of the internet into the general population is faster in developed than in developing nations, studies from other nations are needed to support such a conclusion. In addition, other significant studies could include country-specific cases to investigate the quantitative relationship between internet diffusion and the economic, social, and technological environment.

11. Mendoza and de Toledo, *op cit*, Ref 4.