Rethinking digital divide research: datasets and theoretical frameworks

by Kate Williams, katewill@illinois.edu

This chapter tells the US history of the term digital divide, affirms its rootedness in 20th century history, and then reviews empirical research in the US and national data collection in China. Finally, it summarizes and compares several theoretical frameworks for the digital divide. Both the empirical and theoretical approaches are useful for future work in this area.

1 Origin of the term “digital divide”

In a series of January 2001 emails (Irving 2000) on the U.S.-based public listserv digitaldividenetwork, then operated by the policy group called the Benton Foundation, list moderator Andy Carvin and others presented their research and recollections of how and when the expression “digital divide” arose. During 1995-1997, both the U.S. administration and U.S. journalists used the term to describe the social gap between those involved with technology, particularly between children and their schools. Speaking of a mobile computer lab in a truck, Al Gore said, “It’s rolling into communities, connecting schools in our poorest neighborhoods and paving over the digital divide.”

Larry Irving was the founding head of the National Telecommunications Infrastructure Administration at the US Department of Commerce, to which we will return later for their national survey data. In the email exchange, Irving affirms that the NTIA household surveys were “the catalysts for the popularity, ubiquity, and redefinition” of the term. As these early surveys defined it, the digital divide is the social gap between those who have access to and use computers and the Internet and those who do not. The surveys examined the household penetration of telephones and computers and uncovered demographic patterns of information and communications technology (ICT) access and use. Among other things, the studies revealed a “racial ravine” (Falling through the Net 1999, p 8)—a persistent and widening disparity between rates of ICT access and use by white Americans and African Americans.

In the email exchange, Larry Irving defends the term from recent attacks, most prominently by the Republican appointee to the Federal Communications Commission chairmanship, and notes the wrongheadedness of trying to take a phrase that has near universal acceptance (expect for a few K Street and Tysons Corner lobbyists) and understanding and turn it into typical Washington style Orwellian Newspeak, (i.e. Digital Opportunity, a truly meaningless and worthless term.) (Irving 2000)

Elsewhere, Irving roots U.S. concern about the digital divide in “our nation’s almost century long commitment to universal service,” (Irving 2001) which in the 1934 Communications Act referred to telephone service. And at the same time as the NTIA was carrying out large national surveys to
measure the digital divide, it was implementing the Technology Opportunities Program, which was federal policy initiative to advance local community use of ICTs to solve local problems. (Williams 2007)

As Irving understands, names are important. The French have debated whether to call the digital divide a “fossé numérique” (digital ditch) or a “fracture numérique” (digital fracture). (Garrett 2001) These debates are rooted in a deeper history of the term, which we will now explore. This involves acknowledging the information technology revolution and the social polarities associated with it.

**Digital divide: rooted in 20th century history**

Without the digital, there could be no digital divide. What is the origin of the digital, of the electronic and binary form of information? Many people in many countries have made theoretical and practical contributions to the rise of the digital computer. Claude Shannon, then at Bell Labs in the US, postulated the bit in a thought experiment published in 1948. The information technology revolution has in many ways been the result of implementing Shannon’s “engineering theory of communications,” which was that information translated into 0s and 1s could be sent from source to destination via a channel.

By most accounts, the digital revolution has been underway for more than 60 years. Just a few of the many names and sources for conceptions of this phenomenon have been:

- computer revolution (Berkeley 1962, cited in Beniger 1986, p 4-5)
- knowledge economy (Machlup 1962, cited in Beniger 1986, p 4-5)
- global village based on new mass media and telecommunications (McLuhan 1964, in Beniger 1986, p 4-5)
- scientific-technical revolution (Prague Academy, cited in Beniger 1986, p 4-5)
- third wave (Toffler 1980)
- post-industrial/post-service revolution; information revolution (Jones (1982)
- informationalism (Castells 1989), and
- network society (Castells 1996).

Beniger (1986) provides a much larger collection of conceptualizations of what Jones calls the “economic paradigm shifts” of the last 20th century. But even the few sources includes here indicate how scholars have seen that the computer, telecommunications, knowledge, and information are at the heart of this social revolution. Beniger also demonstrates that the then-Soviet Bloc recognized and was studying these same developments. Toffler and Castells are just two who also include biotechnology, itself based on computers used in biology research and on a concept of information (the four nucleotide pairs that make up genetic material) that is rather similar to Claude Shannon’s bit.

Toffler’s Third Wave (1980) was the popularization of the concepts of a third technological revolution following the agricultural and the industrial, a revolution based on developing and linking new technologies—computers and electronics, materials from outer space and the oceans,

Castells (1996) presents the concept of the network society: A network of information and communications networks, organizations and people forms the backbone of knowledge generation and information flow, including financial and commercial transactions, marketing, culture. Just as the early builders of electricity systems and telephone systems understood, value arose from the number of customers or nodes on the network. And we return to the concept of the binary digital divide: one can be on or off the network.

This computer revolution did not take place in a vacuum. Castells and Jones are among those who describe a social polarization within the information technology revolution, within the new society. Castells, in a paper titled, “The informational city is a dual city: Can it be reversed?” writes:

[T]he two processes, informationalization and dualization, are intertwined under the current social, political, and economic conditions in most of the world, certainly including American cities. New information technologies are certainly not the cause of this association between informationalization and sociospatial exclusion. The roots of social exclusion are in the politics of capitalist restructuring that have prevailed in most societies since the 1980s. The power of new information technologies, however, enhances and deepens features present in the social structure and in power relationships. … A real possibility exists of evolving toward systemic urban schizophrenia, that is, toward the dissolution of urban civilization in an undifferentiated exurban sprawl through telecommunicated/freeway-connected, discontinuous spaces, leaving behind “black holes” of poverty, dereliction, and ignorance, abandoned to their fate. (Castells 1999, page 28)

A number of scholars have provided conceptions of social polarity within the information technology revolution:

- the underclass or the truly disadvantaged (Wilson 1987)
- public sphere and counterpublic sphere—proletarian, Black, feminist (Habermas 1989, Fraser 1992, Negt and Kluge 1993), Dawson 1994, Alkalimat and Williams 2000), and as mentioned above
- racial ravine (Falling Through the Net 1999)

After examining the African American communities of Chicago, William Julius Wilson presented the concept of the underclass, living in communities recently abandoned by the Black middle class and working class and now inhabited only by unemployed or only briefly employed people and thus isolated from the “job network system that permeates other neighborhoods”. (Wilson 1987 p 57) A set of writers explicitly connect the concept of class society to the information technology revolution. McChesney (1996) documents the concentration of wealth and power in just five to eight global media companies making use of ICT and deregulation for cross selling that puts other media organizations at a disadvantage. Perelman (1998) describes the social fractures and the “panopticism” (worker surveillance) involved in what he calls the “mirage of the classless
information society”. Dyer-Witheford (1999) sees the information age as the latest battleground in the encounter between capital and labor, while Hodges (2000) asserts that the expertise of the knowledge worker has overtaken the capital of the corporate owner so that today’s class struggle is in fact post-capitalist, between the professional and the ordinary worker. Among the most vivid and nonchalant of these descriptions of class in the information age comes from the then-president of the European Bank for Reconstruction and Development, Jacques Attali:

Severed from any national allegiance or family ties by microchip-based gadgets that will enable individuals to carry out for themselves many of the functions of health, education, and security, the consumer-citizens of the world’s privileged regions will be “rich nomads.” Able to participate in the liberal market culture of political and economic choice, they will roam the planet seeking ways to use their free time, shopping for information, sensations, and goods only they can afford, while yearning for human fellowship, and the certitudes of home and community that no longer exist because their functions have become obsolete. Like New Yorkers who every day face homeless beggars who loiter around automated teller machines pleading for spare change, these wealthy wanderers will everywhere be confronted by roving masses of “poor nomads”—boat people on a planetary scale—seeking to escape from the destitute periphery, where most of the earth’s population will continue to live. These impoverished migrants will ply the planet, searching for sustenance and shelter, their desires inflamed by the ubiquitous and seductive images of consumerism they will see on satellite TV broadcasts from Paris, Los Angeles or Tokyo. (Attali 1991 p 5)

Distinct from the discussions of class society in the information technology revolution is a another theoretical debate concerning social polarity. This is the discussion of the public sphere and the counterpublic sphere. The public sphere is the site of public discourse, a discourse which shapes intellectual and cultural life, policy and public opinion and, along with the economy, the state, and the family sphere, constitutes a society, serving as a space from which to critique the three other spheres. Various scholars have answered this concept, with descriptions of a counterpublic sphere or spheres, created and used by those who have been excluded from the public sphere in order to make their critiques and bring about transformation. Fraser describes the late 20th century feminist subaltern counterpublic, with its … journals, bookstores, publishing companies, film and video distribution” (Fraser 1992 p 123) creating new vocabulary such as the word sexism. Negt and Kluge (1993) examine a proletarian counterpublic sphere in dynamic opposition to the bourgeois public sphere as technologies and media evolve. Dawson relates: “An independent Black press, the production and circulation of socially and politically sharp popular Black music and the Black church have provided institutional bases for the Black counterpublic since the Civil War.”(Dawson 1994 p 206) Alkalimat and Williams (2000 p 25) document how a community technology center in the African American inner city can be a new institutional base for a counterpublic sphere by means of social cyberpower, the effective use of ICT by groups of people.

In sum, then, the term digital divide has an etymological history which has a strong basis in quantitative data in the United States as well as actual roots in the evolution of the digital revolution and the social polarities it inherited, enhanced, and deepened.
Empirical data on the digital divide

Having identified the digital divide as a social phenomenon rather than merely a technological one, we can now proceed to evaluate how social science has mobilized to measure and understand it. Appendix 1 summarizes a collection of 31 social surveys or reports of surveys concerning the digital divide spanning the years 1995 to 2000: 30 from the U.S. and one from the U.K. These surveys were coded according to three dimensions: as having either a national or a local focus, as taking either the individual/household or the community institution as a unit of analysis, and which sector collected the data.

The baseline research questions across many of the individual or household studies are the same:
   - Do you have a computer at home?
   - Do you use a computer at work?
   - Do you use a computer elsewhere?

These questions correspond to three different settings for computer/Internet use, and allow us to organize the field of digital divide research by three types of computing: personal computing (at home), private computing (on the job), and public computing (not at work or at home). Chow 1998, Stoecker 1997 and Williams 2004 identify 29 wide-ranging settings for public computing: universities, schools, libraries, but also cybercafés, laundromats, and housing developments. Judging from the 32 surveys in appendix 1, only a few public computing settings have been the subject of a digital divide survey or a location for a digital divide survey of individuals. There are also country studies and global studies of the digital divide (for example Barnard 2001, Courrier 1997, Understanding the Digital Divide 2001). But none of those obtained for this paper were surveys.

The coding of the Table 5 suggests where the focus of research has been. National surveys outnumber local surveys 23 to 8. Surveys of individuals outnumber surveys of community institutions 20 to 11. Only one survey of individuals focused on workers and therefore was located in the realm of private computing. Just one survey of community institutions was of a virtual institution: the community network. (See van den Besselaar 2000 for a case study of two European digital cities, also virtual).

The extensive social informatics literature on workplace transformations in the digital age has largely relied on case studies, ethnographies, interviews, participant observation and other close-up methods. To find surveys of business organizations, a further exploration of the U.S. Census Bureau and other US federal agencies might fill what appears here as a gap.

With respect to the type of institution that collected the dataset: the government began surveys on this issue 1984; academics in 1994, commercial survey organizations in 1996, and non-profits in 1998. Different sample sizes can lead to different results: Novak 1997, 1998 and Hoffman 1999, 2000 used data from Nielsen/CommerceNet, and offer percentages for white and African American households with computers that appear to overestimate computer ownership compared to data from the much larger U.S. Census/Falling through the Net studies.
In general, the largest and longest running surveys are the government surveys, particularly the U.S. Census (reported in Kominski 1999) and the Falling through the Net studies, which have been carried out in partnership with the U.S. Census.

The 32 quantitative surveys of the digital divide show that the digital divide has been quantified in different ways across three domains of social life (home, workplace, and public spaces) and three corresponding types of computing. For the United States, chief among the public spaces are the nation’s public schools and libraries.

Making use of the 16 year span of data collection by the U.S. Census Bureau and their Falling through the Net partners, we can operationalize the three types of computing as shown in Table 1 below. Personal computing is operationalized as households with computers (and later internet) at home; private computing as individuals using computers at work; and public computing as people using computers at school.

<table>
<thead>
<tr>
<th>Year</th>
<th>Percent of households with computer at home</th>
<th>Percent of households with internet at home</th>
<th>Percent of people using computer at work, age 18+</th>
<th>Percent of people using computer at school, age 3-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984</td>
<td>8.2</td>
<td>--</td>
<td>24.6</td>
<td>28.0</td>
</tr>
<tr>
<td>1989</td>
<td>15.0</td>
<td>--</td>
<td>36.8</td>
<td>46.0</td>
</tr>
<tr>
<td>1993</td>
<td>22.8</td>
<td>--</td>
<td>45.8</td>
<td>60.6</td>
</tr>
<tr>
<td>1997</td>
<td>36.6</td>
<td>18.6</td>
<td>49.8</td>
<td>70.8</td>
</tr>
<tr>
<td>1998</td>
<td>42.1</td>
<td>26.2</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2000</td>
<td>51.0</td>
<td>41.5</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2001</td>
<td>56.2</td>
<td>50.3</td>
<td>53.5</td>
<td>--</td>
</tr>
<tr>
<td>2003</td>
<td>61.8</td>
<td>54.6</td>
<td>55.5</td>
<td>83.5</td>
</tr>
<tr>
<td>2007</td>
<td>--</td>
<td>61.7</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2009</td>
<td>--</td>
<td>68.7</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2010</td>
<td>--</td>
<td>71.1</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Table 1. Three domains of computer/internet access and use, with national US data: personal, private, and public. Sources: XXX.

Table 1 points up public computing as the most distributed across the population, one could say (but only very roughly) the most democratic, reaching 60.6% of children by 1993. We can see personal computing as the least distributed, even as recent as 2003 when it included 61.2% of households by 2000.

Crosstabulating technology data with demographic data points up digital divides not just between individuals, but between socioeconomic groups. Some groups are more likely to be “wired” than others.

Before we move on, we must take note of at least three caveats to this data. First, what devices are included and not included? Low income urban US populations took up pagers early on as an inexpensive alternative to a phone, and today in every country people are texting; this data looks
presents only the personal computer. Second, school is not all of public computing. Colleges, universities, libraries, are also important sites for public computing, not to mention all the 29 types of sites mentioned above. They may not be as equalizing as K-12 school computer usage is.

Third, school is compulsory. Compulsory computer use might be good at equalizing usage, but is it desirable? Is it something to rely on exclusively?

Finally, and we will discuss this more below, a great deal of information about the varied reality of personal, private and public computing, will remain invisible as long as we just examine answers to the baseline research questions.

But these three figures, limited just to data on the three baseline research questions regarding the digital divide, suggest a second dimension to our nascent research framework of personal, private, and public computing. We now can see there are various types of people who either use those sites or do not. Table 2 provides a 3 by 8 matrix which identifies eight types of individuals in a digitally divided society.

<table>
<thead>
<tr>
<th>Netizenship: connected in three locales</th>
<th>Personal computing</th>
<th>Private computing</th>
<th>Public computing</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Cyberactivism: connected in two locales</td>
<td>+</td>
<td>–</td>
<td>+</td>
</tr>
<tr>
<td>+</td>
<td>–</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Online: connected in one locale</td>
<td>–</td>
<td>+</td>
<td>–</td>
</tr>
<tr>
<td>Digital excluded: no direct connection</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

Table 2. Becoming digital: A typology of individuals in a digitally divided society

In the dynamic societies across the globe today, one can postulate that people are moving from exclusion to netizenship through various middle stages. Each movement, each stage is far more complex than computer ownership, yes or no, or computer use, yes or no. Past and future research from a variety of disciplines can be organized according to which cell or cells in this matrix it examines.

In addition, as in 12 of the 32 surveys we examined, the unit of analysis does not have to be the individual. The institutional setting also needs to be interrogated and understood. For instance, Williams 2000 takes as its unit of analysis the public library outlet. The paper operationalizes public computing as the number of public access PCs in a given public library outlet, and measures that against a community’s digital divide status. The study uses GIS (a geographic information system) and U.S. census demographic data to derive a measure of a community’s digital divide status (as suggested by the national census studies) within one mile of each outlet. The results in figure 1 indicate a definite trend line: library outlets in digitally divided communities have fewer computers than those in communities on the rich side of the divide.
Digital Divide Scale for that Library's Neighborhood
(4 = least access to computers and the internet)

Figure 1. Public computing measured against a community’s need for it; in this city, fewer computers are provided to library branches that are in more digitally divided neighborhoods. (Williams 2000)

In this situation, the public libraries appear to be exacerbating the digital divide. These results bear further research, because the number of computers is an imperfect indicator of public computing: perhaps the libraries with fewer computers have allocated extra money to computer user support, in which case counting computers measures their efforts very poorly.

China and the US

A global phenomenon like the digital revolution, accompanied by country-to-country as well as within-country digital divides, can be best understood using a global approach to research. This is true for solitary scholars as it is for well-resources national surveys. We developed a method to study the questions that are asked by US and Chinese national internet use surveys, and discovered that each country is contributing something different to measuring the digital divide. (This data is more fully reported in Williams and Yan 2009)

Nine categories or general topics, as they are identified in Table 3, emerged from a coding of all the survey questions. The U.S. surveys have emphasized ICT uses, details of connecting to the Internet, places people use ICT, and ownership of digital tools. The Chinese surveys have emphasized ICT uses and people’s attitudes towards all aspects of ICTs. Perhaps reflecting a socialist ideology, there are no Chinese questions about ownership. On the other hand, while China quite steadily maintains a question about “netizens” — with small shifts in the definition of this term — the U.S. survey does not conceptualize or name people who use the Internet. Following from this, the U.S. does not ask people what they know about computers and the Internet, while China asks people if they know certain technological terms from the current discourse.
Table 3. Compared to two other existing frameworks for global standardization of data collection, the US and Chinese surveys cover more of the nine aspects. ITU = International Telecommunications Union; OECD = Organization for Economic Cooperation and Development.

Moreover, as Table 3 indicates, the International Telecommunication Union (ITU) survey poses questions on ICT uses, connecting, places, ownership, devices, and identity (ITU, 2007), while the Organization for Economic Cooperation and Development (OECD) survey poses questions on ICT uses, connecting, places, devices, and frequency (OECD, 2009a, 2009b; OECD Working Party on Indicators for the Information Society, 2009). Neither of them asks about attitude or discourse. But both organizations are engaged in an ongoing search for standardized data.

Williams and Yan propose nine archetypal questions (also shown in Table 3) which could be asked worldwide with variation as appropriate to each country, but yielding comparative data. The identity question expresses both practice and self–conceptualization. The discourse question addresses not skills but knowledge, part of mastery of the new tools and the new society. The questions taken together incorporate the U.S. focus that is rooted in the digital divide origins of the U.S. survey: who is connected, where, what are they doing. And they incorporate the Chinese focus on their population’s experience and attitude towards the digital age, conceptualized neatly and powerfully as the netizen.

**Theoretical reflections**

In research, the empirical measures that come from such large surveys as are analysed above are quite often combined with additional social factors for a richer analysis. They are then summed up theoretical frameworks. Table 4 presents three such frameworks that have been published in the US and Europe, with the leftmost column commenting on and summarizing them. Clement and Shade (1998) propose a seven-part “access rainbow:” carriage facilities (the network), devices, software, online content and services, service/access provision (by which they mean public computing), literacy/social facilitation (the latter meaning training and support), and governance (by which they mean democratic control of cyberspace such as by means of an electronic commons.)
DiMaggio and Hargittai propose five components to digital inequality, a term they offer as a more modern and accurate term to cover not only the binary access/lack of access but many variations in access that have emerged as technology diffuses. Their five dimensions are equipment, autonomy of use (which includes place of use, so they compare personal, private and public computing), skill, social support and the purpose of ICT use. Van Dijk offers four components to what he sees in 2005 as the “deepening” digital divide: physical access, motivational access, skills access and usage access. His framework is explicitly relational, meaning that the digital divide inheres in the relations between people, classes, and so on.

In summarizing these three theoretical frameworks into the set of concepts in the leftmost column in table 4, I have sought concepts which are supported by broad literatures—which themselves may have nothing to do with computers. Agency, for example. Especially in phenomenon involving people who are relatively powerless, it is most accurate—but sometimes hardest for a researcher—to start from the agency of people themselves. Any innovation will only be adopted if people see it advancing their own agency, their own interests. Likewise, social support. A vast literature about social support can be martialled to understand how support works. The concept of literacy is also broad and points to the multidimensionality of computer use. It is also worth noting that governance, the question of who controls the electronic spaces that we use and in effect inhabit, was advanced in 1998 but has dropped out of the later models, even though today users turn to the “cloud” as a place to keep their data, internet service corporations which were household names are today out of existence, and governments (the US included) are considering initiatives that enable them to close down the internet if deemed in the national interest.

In the end, to understand and overcome the digital divide, factors explicitly advanced in theories and factors which are implied, but not stated, in our empirical research need our consideration.

<table>
<thead>
<tr>
<th>Software, hardware, and the network</th>
<th>Carriage facilities</th>
<th>Equipment</th>
<th>Physical access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Devices</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Software tools</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data</td>
<td>Content/services</td>
<td>Purpose of use</td>
<td>Usage access</td>
</tr>
<tr>
<td>Agency</td>
<td>Governance</td>
<td>Autonomy of use</td>
<td>--</td>
</tr>
<tr>
<td>Computer literacy</td>
<td>Literacy/social facilitation</td>
<td>Skill</td>
<td>Skills access</td>
</tr>
<tr>
<td>Social support</td>
<td>Governance</td>
<td>Social support</td>
<td></td>
</tr>
<tr>
<td>Place</td>
<td>Service/access provision</td>
<td>Autonomy of use</td>
<td>--</td>
</tr>
</tbody>
</table>

Table 4. Summarizing across three theoretical frameworks for the digital divide.
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various charts from www.census.gov.


<table>
<thead>
<tr>
<th>Citation (note that year of citation may not equal year of data collection)</th>
<th>N</th>
<th>Unit of analysis</th>
<th>National or local</th>
<th>Individual or community focus</th>
<th>Dataset</th>
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<tr>
<td>John J. Heldrich Center for Workforce Development 2000</td>
<td>1005</td>
<td>Adults in the workforce</td>
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<td>I</td>
<td>academic</td>
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<td>N</td>
<td>I</td>
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<tr>
<td>Turow 2000</td>
<td>1001 parents and 304 children</td>
<td>Parents and their children</td>
<td>N</td>
<td>I</td>
<td>academic</td>
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<tr>
<td>Birdsell 1998</td>
<td>15000 in 15 different surveys</td>
<td>Individuals</td>
<td>N</td>
<td>I</td>
<td>commercial</td>
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<td>Lenharet 2000, also Spooner 2000</td>
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<td>N</td>
<td>I</td>
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<td>McConnaughhey 1995</td>
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<td>government</td>
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