Structural change in large police agencies during the 1990s

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Abstract *According to community policing advocates, police agencies should implement a variety of important organizational changes. These changes are supposed to occur in a number of different substantive domains, including the culture, behavior, and structure of police organizations. This paper examines the evidence for change in just one of these domains: formal organizational structure. Based on concepts derived from organization theory, and using data from six different data sets, the paper explores whether the structures of US police organizations changed during the 1990s. Overall, it finds mixed evidence. Some changes have occurred in the direction encouraged by community policing reformers, some changes have occurred in the opposite direction, and some changes have not occurred at all.*

Introduction

The organizational structures of large municipal police departments in the USA have changed substantially throughout the twentieth century (Reiss, 1992). Precinct-based police organizations employing only sworn police officers have transformed into highly centralized, specialized, and formal organizations with tall hierarchies, large administrative units, and a diverse mix of occupational specialties (Fogelson, 1977; Maguire, 1997, 2002; Reiss, 1992).

Over the past two decades, community policing reformers have urged police executives to revamp their organizational structures and administrative practices in a number of ambitious ways (Redlinger, 1994). Police executives have been implored by reformers to reduce the size of their administrative components; to decentralize, both territorially and administratively (Bayley, 1994; Cordner, 1997; Kelling and Moore, 1988; Mastrofski and Ritti, 2000; Moore and Stephens, 1992; Skolnick and Bayley, 1988; *TELEMASP Bulletin*, 1995); to deformalize (Goldstein, 1990; Mastrofski, 1998), to despecialize (Cordner, 1997; Mastrofski and Ritti, 2000); to reduce the depth of their hierarchies (Cordner, 1997; Mastrofski, 1998; Moore and Stephens, 1992), and to civilianize, replacing sworn officers with civilians in a variety of occupational specialties (Bayley,

1994; Cordner, 1997; Crank, 1989; Lutz and Morgan, 1974; Skolnick and Bayley, 1988). Reformers argue that restructuring police organizations in these ways is essential for community policing practices to take root.

There is little evidence to suggest whether community policing has had an effect on the formal organizational structures of large municipal police organizations in the USA[1]. Wycoff (1994, p. 32) found that only 61 percent of police executives from large municipal police agencies agreed that "community policing requires major changes of organizational policies, goals, or mission statements", while only 34 percent believed that community policing "requires extensive reorganization of police agencies." Consistent with Wycoff's findings, Maguire (1997) found that there were few structural changes implemented in large, municipal police agencies from 1987-1993. Gianakis and Davis (1998, p. 496) concluded that the "organizational impacts of community policing have been minimal". Their research on Florida police agencies found that most efforts at implementing community policing involved attempts to change the officer rather than the organization.

This paper examines the evidence for changes in the structure of large municipal police organizations during the 1990s. It combines six data sets which, taken together, contain longitudinal measures not available in previous research.

Community policing and organizational structure

The community policing movement is complex, woven together over time from a number of separate reform strands both within and outside of policing (Maguire and Mastrofski, 2000). Community policing reformers urge changes in many different substantive areas, from problem-solving and crime prevention efforts to new methods of supervision, management, and administration. Changes in the formal structure of police organizations constitute only one part of the community policing movement. For some commentators, structural changes are the most important part of community policing, while for others such changes represent mere tinkering (Gianakis and Davis, 1998; Maguire, 1997; Mastrofski, 1998; Redlinger, 1994). Regardless of one's stance on the relative importance of structural changes, most reformers view them as one part of an overall shift to community policing.

People often use the term "organizational structure" to refer to an expansive or nonspecific list of organizational characteristics. Among organization theorists, however, the term has a more specific meaning. We begin this section by defining organizational structure. We then outline seven structural features that are prominent in organizational theory and research, all of which play a role, whether explicit or implicit, in the reform agendas of community policing advocates.

According to Maguire (2002):

Organizational structure is the formal apparatus through which organizations accomplish two core activities: the division of labor and the coordination of work.

Mintzberg (1979, p. 2) defines organizational structure similarly:

> Every organized human activity – from the making of pots to the placing of a man on the
> moon – gives rise to two fundamental and opposing requirements: the division of labor into
> various tasks to be performed, and the coordination of these tasks to accomplish the activity.
> The structure of an organization can be defined simply as the sum total of the ways in which
> it divides its labor into distinct tasks and then achieves coordination among them.

According to these definitions, measures of an organization's structure should
reflect the methods used by the organization to divide labor or coordinate its
work or its workers.

Maguire (1997, 2002) and Langworthy (1986) have each shown how these
traditional definitions, common among organizational theorists and
researchers, translate into measures that are relatively easy to compute and
meaningful for comparing police departments. Taken together, their work
isolates seven specific elements of police organizational structure. The first four
of these are types of structural "differentiation" or methods of dividing labor.
Differentiation, according to Langworthy (1986), takes four forms:

(1) functional;

(2) occupational;

(3) spatial; and

(4) vertical.

Functional differentiation is the degree to which tasks are broken down into
functionally distinct units. A police agency with a homicide unit, an accident
reconstruction unit, and a juvenile division is more functionally differentiated
than one which employs only patrol officers. Occupational differentiation is
the degree to which an organization uses specially trained workers[2].
Occupational and functional differentiation are both measures of division of
labor but are conceptually distinct. Functional differentiation measures
differentiation of tasks (divisions within the organization), while occupational
differentiation measures occupational distinction within the staff (job titles)
(Langworthy, 1986). Spatial differentiation is the extent to which an
organization is spread geographically (Langworthy, 1986; Bayley, 1992). A
police agency with a headquarters and several precinct stations is more
spatially differentiated than a department that operates out of a single police
facility. Vertical differentiation focuses on the hierarchical nature of an
organization's command structure, including its segmentation, concentration
and height. Organizations with elaborate chains of command are more
vertically differentiated than those with "flatter" command structures.
Segmentation is the number of command levels in an organization,
concentration is the percentage of personnel located at various levels, and
height is the social distance between the lowest and highest ranking
employees.

In addition to the four kinds of differentiation, the remaining three elements
of organizational structure are:

(1) centralization;

(2) formalization; and

(3) administrative intensity.

Centralization is the extent to which the decision-making capacity within an organization is concentrated in a single individual or small select group. Organizations in which lower-ranking employees are given the autonomy to make decisions are more centralized than those in which senior administrators make most decisions. Formalization is the extent to which actors within an organization are governed by specific rules and policies. Police agencies are well known for being formalized. Some factors in the external environment of policing, including lawsuits and accreditation, are likely to encourage increases in formalization. Administrative intensity or "administrative overhead" refers to the proportion of organizational resources committed to administration (Crank, 1990; Langworthy, 1986; Monkkonen, 1981; Scott, 1992). Organizations with high levels of administrative intensity are often thought of as being more bureaucratic. Together these three structural elements are referred to in the organizational literature as "control" or "coordination" mechanisms (Maguire, 2002).

Nearly every reference in the community policing literature mentions the need for police organizations to implement some form of structural innovation as part of their overall community policing implementation efforts. For instance, Greene *et al.* (1994, p. 93) argue that:

> For community policing to become a central feature of American law enforcement, the institutional framework and organizational apparatus of police organizations must be altered . . . The success or failure of community policing then is in large measure affected by the organizational structures and processes that characterize modern-day policing.

Specifically, community policing reformers have urged police executives to make a variety of structural changes that align rather neatly with concepts derived from organizational theory: reducing levels of vertical and functional differentiation, increasing levels of occupational and spatial differentiation, and decreasing formalization, centralization, and administrative intensity. This paper examines whether such changes took place among large, municipal police organizations during the 1990s. The findings provide an index of the extent to which police organizational change in the 1990s was consistent with changes sought by community policing reformers.

Data and methods

The data used in this paper come from six sources: three waves of data (1990, 1993 and 1997) from the Law Enforcement Management and Administrative Statistics Series (LEMAS) collected by the US Bureau of Justice Statistics (see Langworthy, 2002); two waves of data (1993 and 1996) on the organizational structures of police agencies collected by Maguire (2002); and data from a 1998 University of Nebraska at Omaha (UNO) survey of police agencies conducted

by Maguire *et al.* (2002). Not all variables are available in all data sets, therefore we have constructed a separate data series for each structural variable[3]. As a result, the data series for each variable might contain data from different years. The findings of our research are limited by data problems in each longitudinal series. While we have developed quality measures of police organizational structures in cross-sectional analyses reported elsewhere, we are constrained by problems in the existing data sets used to form each longitudinal data series. We do our best to work around these problems, but nonetheless, they inhibit our ability to draw firm conclusions about structural change in US police agencies. Table I summarizes the variables examined in this paper and the data sets in which they are available.

Functional differentiation (specialization)
Functional differentiation is the degree to which tasks are divided and assigned to functionally distinct units. Police organizations have become more functionally differentiated throughout the twentieth century, adding new bureaus, divisions, and specialized units to perform separate functions as the need (or perceived need) arises. Under community policing, police organizations are supposed to become less functionally differentiated. Community policing officers are encouraged to become "uniformed generalists"[4] responsible for developing customized responses to a wide variety of situations rather than frequently referring citizens to other more specialized "cubbyholes" within the organization. Maguire (1997) found that police organizations became more, rather than less functionally differentiated from 1987-1993. In addition, there were no differences in functional differentiation between agencies claiming to practice community policing and agencies not making such claims. In this section, we explore changes in functional differentiation from 1990-1997.

Functional differentiation has been measured in a number of ways. In other analyses, we have constructed a cross-sectional measure from the 1997 LEMAS data that is superior to the measures used in this paper for 1990 and 1993. Longitudinal data on special units are available from three waves of the LEMAS survey (1990, 1993, 1997), but the superior measure is only available for 1997[5]. We adopt a measure similar to that used by Reimann (1973, p. 464), who operationalizes "functional specialization" as "the number of discrete, identifiable functions performed by at least one, full-time specialist." Each of the LEMAS survey instruments for 1990, 1993, and 1997 provides a list of functions for which agencies might have a specialized unit. Although the list changes slightly in each wave, 12 of the functions are common across the three waves. Therefore, our measure of functional differentiation is the number of functions out of these 12 for which the agency has assigned full-time personnel to a special unit.

Overall, 353 agencies provided sufficient data to compute functional differentiation scores for each panel[6]. Descriptive statistics on functional differentiation are shown in Table II. We used both parametric tests (paired

Variable	1990 LEMAS	1993 LEMAS	1993 Maguire	1996 Maguire	1997 LEMAS	1998 UNO
Functional differentiation	–	–			–[a]	–[b]
Occupational differentiation	–	–			–	–
Spatial differentiation:						
Police stations			–	–	–[a]	
Mini-stations			–	–	–[a]	–[b]
Beats		–[a]	–	–	–[a]	
Vertical differentiation:						
Segmentation			–	–		
Height	–	–			–[a]	
Centralization			–	–		
Formalization	–	–			–	–
Administrative intensity	–	–			–	–

Notes:
[a] Data contain some noteworthy problems but are still included in the analyses presented in this paper;
[b] Data are available but are not included in the analyses presented in this paper due to problems with reliability, validity, or inconsistency with previous waves

Table I.
Variables and data sources

Structural feature	Measure	1990	1993	Mean 1996	1997	1998	n
Functional differentiation	Number of special units	5.36	5.99	–	5.49	–	353
Occupational differentiation	Per cent civilian	22.4	22.5	–	22.4	24.7	283
Spatial differentiation	Police stations	–	2.09	2.16	–	2.15	3e + 08
	Mini-stations	–	2.22	3.81	–	2.91	
	Beats	–	24.36	26.30	–	22.50	
Vertical differentiation	Segmentation	–	5.94	5.95	–	5.88	3e + 05
	Height	1.21	1.27	–	–	1.34	
Centralization	20-item centralization index	–	53.16	52.13	–	49.13	331
Formalization	Per cent formal policies	9.7	9.78	–	9.89	9.96	300
Administrative intensity	A/P ratio	0.42	0.4	–	0.39	0.36	230

Table II.
Descriptive statistics
for seven structural
features

sample *t*-tests) and non-parametric tests (Wilcoxon signed-rank tests) to explore differences over time[7]. The mean number of specialized units increased significantly from 1990-1993 ($p < 0.001$), and decreased significantly from 1993-1997 ($p < 0.01$). The two changes cancelled each other out, so that the overall change from 1990-1997 was not statistically significant ($p > 0.05$). The results were consistent using both parametric and non-parametric tests. To account for the possibility of familywise error resulting from multiple comparisons, we used a Bonferroni correction. This involved dividing our alpha value (0.05) by the number of tests conducted and treating the resulting value as a new threshold for determining whether a contrast was statistically significant at the 0.05 level. The findings remain the same[8].

It is difficult to know how much faith to place in these findings. The structure of the specialization question changed in the 1997 LEMAS survey by providing police agencies with more options to indicate how they respond to various problems: a full-time special unit, specialized personnel who are called in as needed, or specialized policies and procedures. As Walker and Katz (1995) showed, agencies with specialized personnel (but not a full-time special unit) may have been tempted in previous waves to indicate that they had a specialized unit, just to show that they had in fact taken some steps to deal with a problem. With the current wording of the question, agencies can still show that they are taking a problem seriously without claiming (inaccurately) that they have a specialized unit. We undertook the analysis despite this apparent problem because the direction of the suspected bias is clear. If there was measurement error in the previous question, as we suspect, and if the restructuring of the question reduced this error, then fewer agencies will report having full-time specialized units. Therefore, if we had found that functional differentiation increased, it would have been a trustworthy finding, since the suspected bias works in the opposite direction. Since we found that functional differentiation decreased (in the direction of the suspected bias), it is difficult to know how much of the change identified in this analysis is real and how much is an artifact of restructuring the question. Hence, we do not place a lot of confidence in our finding that functional differentiation decreased from 1993-1997.

Even with these limitations, there is another method that may be useful for examining changes in functional differentiation. We have argued that a change in the format of the survey items forming the functional differentiation measure in 1997 make it difficult to draw inferences about change over time. However, it may be possible to draw such inferences by standardizing the measures for each year by converting them to *z*-scores with a mean of 0 and a variance of 1. Using this standardized metric, we cannot examine mean change over time, since the transformed measures for each year all have the same mean (zero). However, we can examine how agencies are changing relative to the mean for each period.

This analysis demonstrates the same pattern as the previous one. From 1990-1993, more agencies increased their levels of functional differentiation

than decreased. This is consistent with findings reported by Maguire (1997). From 1993-1997, more agencies decreased in functional differentiation, though this may have been an artifact of changes in instrumentation in 1997. Overall, we are left with a slight, nonsignificant increase in functional differentiation from 1990-1997. Perhaps the most confident inference we can draw from these findings is that during the 1990s, American police organizations did not experience the wholesale decrease in specialization urged by community policing reformers. In fact, they may have become even more specialized.

Occupational differentiation (civilianization)
Occupational differentiation is the extent to which an organization relies on specially trained workers (Langworthy, 1986). Although there is some conceptual overlap between functional and occupational differentiation, the former refers to the division of tasks within the organization, while the latter refers to the use of specialized employees from distinct occupational groups. An ideal measure of occupational differentiation is difficult to construct within the constraints of a comparative study of organizations using data from establishment surveys. More intensive study within one or a small number of organizations would probably be necessary to determine the extent to which an organization relies on specially trained workers within different occupational groups. Faced with this limitation, Langworthy (1986) reasoned that civilian police employees represent a separate occupational group, distinct from the sworn police officers who constitute the majority of employees within most police organizations. Furthermore, since civilians come from a number of different occupational specialties, the proportion of employees who are civilians (or civilianization) is a reasonable proxy measure for occupational differentiation[9]. Faced with new technologies and new tasks, police agencies are now employing an increasingly diverse array of civilian employees (Heininger and Urbanek, 1983; King and Maguire, 2000). Therefore, this argument is probably even more valid today than it was when Langworthy's data were collected in the 1970s.

Although civilianization seems like a relatively simple measure, we found numerous problems with the data. In the 1998 survey, agencies were asked to write the actual (not authorized) number of full-time employees in administration, field operations, technical support, court and jail operations, and other areas (this is the same question used in the LEMAS surveys). One column was provided for sworn officers, and one column was provided for non-sworn (civilian) employees. In about half the survey returns, these disaggregated figures did not add up to the total number of sworn or non-sworn employees. To clean the data, we reviewed every problematic survey return. In many cases, these appeared to be nothing but simple addition errors, so we fixed the error. In other cases, it was not obvious which figure was incorrect. Therefore, there are several agencies for which the sum of employees in each category does not equal the total number of employees. It was sometimes impossible to determine which figures were incorrect: the whole, or

the parts. Our assumption is that most agencies can accurately estimate the number of sworn and non-sworn employees, but may have trouble reporting which ones work in the five functional areas listed in our survey. If this is true, then the civilianization estimates from the 1998 survey are not problematic. On the other hand, the administrative intensity estimates discussed later may contain some measurement error because they depend on accurate classification of employees into administrative and operational categories.

We cannot be certain how these errors were handled in the LEMAS surveys, but in each wave, the sum of the components equals the total number of employees[10]. Thus, it appears that when the components did not add up to the whole, the Bureau of Justice Statistics probably changed the total. This is speculation on our part, based on patterns observed in the data. If this was the data cleaning strategy they employed, there may be some problems with civilianization estimates from LEMAS. For instance, data from the Eugene Police Department demonstrate an increase in civilianization from 45 percent in 1990 to 66 percent in 1993 and then back to 38 percent in 1997. This error can be traced to incorrect entries for the number of civilians and the total number of employees. For instance, the number of civilians went from 110 in 1990 to 286 in 1993, and then back down to 102 in 1997. This is an extreme case that was easy to identify and correct; in other cases, civilianization estimates appeared "suspicious" but were within the range of possibility, so we left them. Therefore, it is likely that many more errors remain, in both the LEMAS survey and our 1998 survey data. Nevertheless, these errors probably exist within only a minority of agencies in our sample and should not drastically affect an analysis that is based on mean changes over time (as opposed to one that examines the civilianization trajectory for each agency individually). With these concerns in mind, we now examine changes in civilianization.

Data on civilianization were available for 1990, 1993, 1997, and 1998. Descriptive statistics for civilianization are shown in Table II. From 1990-1993 and from 1993-1997, there were no significant changes in civilianization ($p > 0.05$). This is consistent with earlier work suggesting that civilianization increased throughout the 1980s, but slowed down starting in 1990 (Maguire, 1997). However, from 1997-1998, there was a significant increase in civilianization ($p < 0.001$). The change was large enough so that the change during the entire period of 1990-1998 was also statistically significant ($p < 0.001$). Combining these findings with evidence from other studies, it appears that civilianization continued to grow throughout the 1970s and 1980, leveled off until approximately 1997, and then began to increase once again.

One explanation for the renewed growth of civilianization may be the availability of federal funding to hire civilians through the Justice Department's Community Oriented Policing Services, Making Officer Redeployment Effective (COPS MORE) program. COPS MORE represented an effort to "redeploy" police officers from behind desks and onto the streets through funding for technology and civilian employees. A recent evaluation of the COPS program found that as of June 1998, COPS MORE funding had provided

$287,178,637 to US police agencies to support 12,975 full-time-equivalent civilian positions (Roth *et al.*, 2000). This funding was intended to assist police agencies in hiring community service technicians, administrative assistants, records clerks, civilian jailers, dispatchers, booking clerks, police service officers/assistants, and other civilian employees. The authors of the national evaluation of COPS concluded that COPS MORE provided "modest encouragement" for the ongoing trend toward civilianization in US police agencies.

Spatial differentiation
Spatial differentiation is the degree to which an organization divides its work and its workers over space. Police organizations with a single patrol beat and a single police facility are the least spatially differentiated. Those agencies that carve the jurisdiction into a large number of small beats, with functioning mini-stations scattered throughout the jurisdiction, and district stations in different areas of the community, are the most spatially differentiated. Spatial differentiation, like the other forms of differentiation, is yet another method of dividing up workers and their work (Langworthy, 1986; Maguire, 2002).

Although the term "spatial differentiation" is not usually used in community policing discourse, its essence is the very heart of community policing. Geographic or spatial issues are present throughout the community policing reform literature: the need for police organizations to extend themselves further into their communities, to establish beat boundaries that coincide with neighborhood boundaries, to open up substations in neighborhoods, to create new districts and to open up new (or previously closed) precinct stations. Reformers speak frequently about the need for police organizations to become more "decentralized". While this term has a precise meaning among organization scholars (as we will discuss shortly), it is frequently misused in the community policing literature. Those who are referring to the concentration of decision-making authority within the organization are using the term correctly. Those who use the term alone (without modifiers like "spatial" or "geographic") to refer to issues like expanding the number of beats or opening mini-stations, substations, and district stations, are confusing it with spatial differentiation[11]. When Moore and his colleagues (Moore *et al.*, 1992, p. 33) assembled a panel of policing experts to study police innovation, the panel rated "geographic decentralization" (akin to spatial differentiation) as the second most important administrative innovation in policing, second only to improving education and training of police officers.

Police stations. Elsewhere we have developed several measures of spatial differentiation for use in cross-sectional analyses, but we are limited here by the availability of longitudinal data. The simplest measure is simply the number of 24-hour police stations, including headquarters. Although data are available from the 1997 LEMAS survey, they are not included here due to differences in the form of the question[12]. Data on the number of police stations are available from 1993, 1996, and 1998. Descriptive statistics are presented in Table II.

The distribution of the number of police stations in these agencies is highly skewed. In 1998, for instance, 75.2 percent of the agencies had only one police station. For this reason, we chose to use only non-parametric tests (Wilcoxon signed-rank tests) to draw inferences about change in this section. These tests make no assumptions about the distribution of the data, and furthermore, do not require that the variables are measured at the interval (only the ordinal) level. From 1993-1996, there was a significant increase in the number of police stations ($p < 0.01$). From 1996-1998, there was no significant change. For the whole period, from 1993-1998, the increase in the number of police stations was also significant ($p < 0.05$).

As suggested by the descriptive statistics presented in Table II, the changes are not substantively large, though they are statistically significant. These mean changes mask what may be stronger evidence about shifts in spatial differentiation: the percentage change in the number of agencies adding or eliminating at least one station. From 1993-1998, 6.1 percent of agencies eliminated at least one police station, while 14.1 percent added at least one. Once again, the significance of this trend is masked by the presence of so many agencies with only one police station.

Another indicator of changes in spatial differentiation is the percentage of agencies having only one station. In 1993, 79.2 percent of agencies had only one station. By 1996, this figure dropped to 77.1 percent, and by 1998, it dropped to 75.2 percent of agencies. Taken together, the various forms of evidence we have presented suggest that large municipal police agencies are slowly moving toward increasing spatial differentiation by adding more police stations. While the number of police stations is one element of spatial differentiation that appears to be increasing, there are other elements we have not yet considered.

Substations and mini-stations. One strategy used by many police agencies in the USA to improve service delivery and bolster community relations is to open small, limited-function police facilities known by a variety of names, including mini-stations, substations, community storefronts, or kobans (*TELEMASP Bulletin*, 1995). These small police facilities are frequently located in downtown areas, residential neighborhoods, or shopping malls. They are a means of achieving greater spatial differentiation without the cost of adding new precinct or district stations. Many of the facilities are donated or provided at reduced rent or cost by local merchants or government agencies. Some are staffed by officers, others by civilian employees or volunteers, and others by combinations of these staff members. Some are more functional than others, with those staffed by police officers typically providing a wider range of direct services than those staffed exclusively by citizens or volunteers. The degree of functionality of a substation affects the extent to which it represents a true form of spatial differentiation. In other words, substations offering more services represent more legitimate forms of spatial differentiation than those offering limited services.

In an effort to weed out the less functional substations, the 1993/1996 survey asked responding agencies to report the number of "fixed part-time police

service facilities staffed by sworn police officers (mini-stations, kobans, police posts, storefronts, etc. . . .)." Our experience with this earlier survey led us to suspect that some agencies counted mini-stations with very limited functionality (i.e. those staffed by volunteers and serving as facilities for distributing crime prevention information and department forms). Since we placed a higher priority on developing accurate measures in 1998 than in maintaining the consistency of the longitudinal data series, we modified the survey question in 1998[13]. Respondents were asked to report the number of "fixed part-time police service facilities staffed by at least one sworn police officer *for a minimum of eight hours per day* (include mini-stations, kobans, police posts, storefronts, community centers, etc. . . .)." The italicized section was added in an effort to ensure that agencies counted only those mini-stations to which officers were routinely assigned (as opposed to those that they occasionally visit). This change in the format of the question means that fewer mini-stations will probably be reported than if the question remained the same. Therefore, although the different waves of data are not strictly comparable, we know the direction of the bias. If we find that the number of mini-stations has increased from 1996-1998, it will be a trustworthy finding because it works in the opposite direction of the suspected bias. On the other hand, if we find a decrease, we will not know if it is due to an actual decrease or to the change in the format of the question. Table II provides descriptive statistics on the number of functional mini-stations in 1993, 1996, and 1998.

As with the number of police stations, the mini-station variable is not normally distributed, therefore the results presented here are based on non-parametric tests. The mean number of mini-stations increased significantly from 1993-1996 ($p < 0.001$) and decreased significantly from 1996-1998 ($p < 0.001$). Once again, we cannot be sure how much of the recent decrease in mini-stations is due to an actual decrease and how much is due to the change in the format of the survey question. Nonetheless, the net change during the whole time period represents a statistically significant increase, as found using both parametric ($p < 0.01$) and non-parametric tests ($p < 0.001$).

Two additional pieces of information are also useful for thinking about changes in the number of mini-stations. First, the total number of mini-stations reported by these 311 agencies rose from 690 in 1993, to 1,185 in 1996, and then dropped to 904 in 1998. Even with any bias introduced by changing the format of the survey question, we can still report that there were at least 214 more mini-stations among these 311 agencies in 1998 than there were in 1993. Thus, there has been clear growth in the use of mini-stations. Second, the number of agencies (out of 311) with at least one mini-station grew from 176 in 1993 to 240 in 1996, then dropped to 202 in 1998. Once again, even if the 1998 data serve as a more restricted estimate of the number of mini-stations than estimates from previous years, we can claim with confidence that at least 26 new agencies (again, out of 311) adopted mini-stations between 1993 and 1998. Given the direction of the bias in 1998, this is probably a lower-bound estimate. We are

much less confident in our finding that the use of mini-stations declined from 1996-1998.

The period from 1993-1996 was one of intense growth in the establishment of mini-stations. More than half of the agencies in our sample added mini-stations during that period, while only a handful reduced the number of mini-stations. However, from 1996-1998, more agencies experienced decreases than increases. Yet, the 1998 survey instrument used a more restrictive definition of mini-stations than the earlier instrument used to collect 1993 and 1996 data. This more restrictive definition meant that the number reported in 1998 was likely to be lower than in 1993 and 1996, even if the total number of mini-stations (both full and limited function) did not change. This causes an analytical problem parallel to the one we encountered earlier with functional differentiation: do we interpret differences as substantive changes or as instrumentation effects? We know that more than half of the agencies reported no change, or an increase in the use of mini-stations between 1996 and 1998. Of the remaining 43.4 percent of agencies reporting a decrease, we cannot be certain how many of those agencies experienced a true change in the number of mini-stations and how many were simply responding to differences in the form of the question. However, we do know that, despite changes in instrumentation, 43.4 percent of agencies report an increase in the use of mini-stations during the full study period. This is clearly greater than the 25.1 percent of agencies reporting a decrease, especially when we consider that some of the agencies included in the latter percentage probably did not experience a true decrease. Therefore, we can conclude with some confidence that large municipal police agencies experienced growth in the use of mini-stations from 1993-1998.

These various sources of evidence about the use of mini-stations augment the earlier evidence we presented on the increase in the number of police stations. According to both measures, large municipal police agencies became more spatially differentiated from 1993-1998.

Beats. While some police work is done in fixed "brick-and-mortar" facilities like police stations and mini-stations, most of it is done on the streets. Most police work emerges from a police vehicle. In the vehicle, officers typically either receive dispatches instructing them to respond to community members requesting their assistance, or they patrol proactively until they come upon a situation in which their assistance or presence is warranted. The police vehicle plays a central role in the spatial dispersion of the agency. As Maguire (2002) writes:

> A police car is a rolling office, complete in many cases with a trained street-level bureaucrat representing the agency, blank forms designed for many different situations, multiple means of contacting the central office (the dispatch center), and in recent years, even a mobile computer. The greater the number of vehicles that police agencies use on patrol, the greater the spatial coverage of the agency.

For these reasons, patrol coverage, as measured by the number of beats, is an important method for understanding the spatial differentiation of a police agency (Langworthy, 1986).

Many previous efforts to measure beats, both by the Bureau of Justice Statistics in its LEMAS series, and by the FBI in its Police Employees series, have encountered difficulty with data quality (Langworthy, 2002; Maguire, 2002; Uchida and King, 2002). In 1996, Maguire (2002) collected beat data for 1993 and 1996 that were similar to the measures used by Langworthy (1986). The survey asked all respondents to provide the average number of motorized patrol vehicles that were deployed during the day shift and the night shift. Maguire (2002) then used the average of these figures to compute a measure of spatial differentiation. While the resulting measure was useful, there was still room for improvement[14]. The 1998 survey used nearly the same question format to preserve the integrity of the longitudinal series, but added one additional column for data describing the evening shift. We have used the evening shift data elsewhere in cross-sectional analyses, but we have not used them here because only one wave of data is available.

Table II shows the mean number of beats across the day and night shifts for 1993, 1996, and 1998. The number of beats increased significantly from 1993-1996 ($p < 0.001$ for both parametric and nonparametric tests), and then decreased significantly from 1996-1998 ($p < 0.05$). The latter change is rendered insignificant once the Bonferroni correction is applied to the significance level. Overall, there was no significant change in beats from 1993-1998 ($p > 0.05$). According to this measure, there was not a net change in spatial differentiation from 1993-1998.

The analysis shown here relies on a measure of beats that is consistent with previous research, but which can probably be improved. So far, beat measures have been cast in absolute terms: the number of patrol vehicles used by the agency. Using this measure makes it difficult to compare agencies of different sizes because organization size explains most of the variation in spatial differentiation. For instance, Maguire (2002) found that his eight predictors explained 98 percent of the variation in spatial differentiation, with organization size having the most explanatory power in the model. Just as smaller communities have fewer crimes than larger communities, smaller communities have fewer patrol vehicles. Yet, we typically express crime rates in relative terms, per unit population, while expressing beats in absolute terms. In developing measures of relative beat coverage, substantial testing and development needs to be devoted to determining the appropriate denominator, whether population, the number of officers, the size of the area, or some combination of these factors. We do not have sufficient space here to investigate this matter in more detail, but clearly the concept of spatial differentiation can be measured in much more precise terms than we have attempted here. This is one area in which geographers can make important contributions to theory, research, and policy.

Summary of spatial differentiation. Taken together, the evidence in this section suggests that the period from 1993-1996 was one of increasing spatial differentiation in US police departments, whether measured using the number of police stations, mini-stations, or beats. From 1996-1998, this trend slowed,

with agencies either remaining at existing levels or undoing some of the increased spatial differentiation they experienced from 1993-1996. During the whole period, from 1993-1998, the evidence confirms increasing spatial differentiation in the form of police stations and mini-stations, with no appreciable change in beats.

Vertical differentiation

Vertical differentiation refers to the nature of an organization's hierarchy. According to Langworthy (1986), vertical differentiation has three components: segmentation (or layers), height, and concentration[15]. Segmentation is the number of separate levels of command within the agency, from the lowest ranking to the highest. Height is the degree of social distance between the lowest and highest ranking employees in the organization. Greater segmentation and height produce greater levels of vertical differentiation. Concentration is the relative size of some given stratum within the organization compared to others above or below it. Langworthy (1986), for instance, measured concentration using the size of the lowest stratum relative to all those above it. We have chosen not to examine concentration because recent research has shown that, although it is clearly related, it is not a reliable indicator of vertical differentiation (Maguire, 2002).

Community policing reformers have urged police agencies to reduce the depth of their hierarchies to improve the flow of communication throughout the organization. This recommendation flows from a broader movement in both the public and the private sectors to "flatten" or "delayerize" the organization (Mastrofski, 1998; Osborn and Gaebler, 1992). King (2003) argues that the existing research base is insufficient to support the conclusion that reducing the depth of the hierarchy will improve communication or other characteristics of organizations.

In other work, King (2002) suggests a radical revision in the way we think about the police hierarchy. Drawing on the work of Evan (1993), he suggests that there are several hierarchies in a police agency. He isolates five of them: skills, rewards, seniority, status, and authority. The authority hierarchy is the one most people associate with the term "hierarchy". King argues that focusing only on the authority hierarchy distorts the way that multiple hierarchies operate both individually and interactively within a police agency. Segmentation falls within King's authority hierarchy, while height falls within either the rewards or the status hierarchy[16]. Because they are the only two measures available to us in this study, segmentation and height are the only ones we examine.

Segmentation. Segmentation is the number of separate command levels in the organization, from lowest to highest. As we discussed earlier, this is different in many agencies from the number of ranks. Although there are certainly many similarities in the rank systems used by large police organizations, there are also some important differences. For some organizations, ranks denote pure hierarchical differences, in which each rank is

subordinate to the rank above and superordinate to the rank below. Others maintain "status" ranks which carry greater prestige and/or pay, but no supervisory or command authority other than in very limited circumstances (King, 2002). Common examples are master police officers and corporals in some agencies, who are only given supervisory authority on rare occasion, such as when a sergeant is unavailable. Other rank structures are a mix of functional and hierarchical differentiation. The classic example of this is the detective "rank", which is still listed as a formal rank by many police organizations, particularly those on the east coast. Although detectives may receive greater pay and prestige than other officers (often described by survey respondents as equivalent to a patrol sergeant), they do not have greater supervisory or command authority. We found in an earlier survey that police organizational survey respondents have a difficult time understanding the difference between command levels and their own rank structures, therefore we simply asked them to list their ranks (Maguire, 2002). We then re-coded their rank structures as necessary. In most cases this was a simple process, but in others it was necessary to call the agency for clarification. Unlike other sections of this paper, we do not find cause for alarm about data quality issues in this section.

Data on the number of command levels were available for 1993, 1996, and 1998. Table II presents descriptive statistics for all three waves 1996. From 1993-1996, there was not a significant change in the mean number of command levels ($p > 0.05$ using both parametric and nonparametric tests). From 1996-1998, there was a significant decrease ($p < 0.05$). Although the change is substantively small, it is statistically significant even after applying the Bonferroni correction. For the overall period of 1993-1998, the change was not statistically significant ($p > 0.05$). These findings were consistent using both parametric and non-parametric tests. These tests are relatively weak when we consider that the majority of agencies have simply maintained the same number of command levels. Among the minority that have made changes to their rank structures, it may be useful to examine their changes more closely.

Another way of looking at changes in segmentation is to examine the number of agencies adding and dropping levels of command. Perhaps the strongest statement that can be made is that more agencies are dropping command levels than adding them. From 1993-1998, 56 agencies dropped at least one level, while 42 agencies added at least one level. This is not the strong trend toward "flattening" the organization that reformers have envisioned.

Height. Height is the amount of social space from the bottom to the top of the organization. Police agencies in which patrol officers can drop in routinely to chat with the chief of police are less vertically differentiated than those in which there is significant social distance between the chief and the lowest ranking employees. Although it is difficult to measure social distance using data derived from establishment surveys, several researchers have relied on a proxy measure computed using the standardized pay differential between the lowest and highest ranking members of the organization (Langworthy, 1986; Maguire, 1997, 2002). Data were available from 1990, 1993, 1997, and 1998 to

construct a measure of height. Unfortunately, the 1997 LEMAS survey used a different question format when asking about the salaries of police employees, and we believe this change resulted in data that are inconsistent with the other three waves. Therefore, we have chosen to exclude the 1997 measure, which leaves three waves of data on height: 1990, 1993, and 1998. Table II provides descriptive statistics on height for these three waves.

The measure of height used here has a simple intuitive interpretation. It is the percentage pay difference between entry level officers and the chief executive. A score of 0.25, for instance, means that the chief makes 25 percent more than entry level officers. A score of 1.0 means that the chief's salary is 100 percent higher than (or double) an entry level officer's salary. The greater the value of height, the greater the level of vertical differentiation. From 1990-1993, the increase in height is statistically significant using a non-parametric test ($p < 0.05$), but insignificant using a parametric test ($0.1 > p > 0.05$). Since height is not normally distributed, we rely on the non-parametric test results. From 1993 to 1998, the change is insignificant according to both tests. Throughout the whole time period, from 1990-1998, the increase in height is statistically significant according to both tests ($p < 0.01$).

Summary of vertical differentiation. Taken together, our findings on changes in segmentation and height provide little room for optimism among those reformers urging police organizations to become less vertically differentiated, or to "flatten" their rank structures. Changes in segmentation were meager, though more agencies appear to be dropping levels of command than adding them. The majority of agencies did not change the number of command levels in the time period studied. Changes in height were statistically significant for the whole period (1990-1998). If the proxy measure we constructed based on reported salaries is in fact a reliable indicator of social distance, then this distance appears to be increasing. Thus, by one measure we find an almost imperceptible decrease in vertical differentiation, while on another measure we find a significant increase. Together, these findings demonstrate that large municipal police organizations have not experienced a significant reduction in vertical differentiation in the 1990s.

Centralization
Centralization is the degree to which decision making within an organization is concentrated. The opposite of centralization is decentralization, or shared decision making, and it is one of the hallmarks of community policing[17]. Organizational reformers in the 1990s hailed the benefits of decentralization for both business firms and public agencies (Clemmer, 1995; Osborn and Gaebler, 1992)[18]. Police reformers followed suit, as the community policing reform rhetoric began to embrace concepts such as "participatory management", "empowerment" of lower level employees, supervisors, and administrators, and "shared" decision making. Research on police innovation has shown that decentralization is viewed by experts in policing as one of the most important administrative innovations of the 1990s (Moore *et al.*, 1992).

Our measure of centralization was constructed using a 20 item additive index, designed by Maguire (2002), which is available for three waves (1993, 1996, and 1998). Scores on the centralization index can range from 20 (the organization is completely decentralized, with decision-making authority resting at the lowest stratum) to 80 (the organization is completely centralized, with all decisions made by the chief executive). It comprises two subscales, each measuring the locus of decision making within the organization: one subscale addresses the autonomy of supervisors, and the other addresses the extent to which senior level administrators allow lower ranking personnel to make decisions. Alpha reliability coefficients suggest that the indices for each year are internally consistent (0.80 in 1993, 0.79 in 1996, and 0.78 in 1998). Table II provides descriptive statistics for the centralization indices in 1993, 1996, and 1998.

Mean decreases in centralization were statistically significant during all three periods examined: from 1993-1996 ($p < 0.01$ using the parametric test and $p < 0.001$ using the nonparametric test), from 1996 to 1998 ($p < 0.001$ using both tests), and from 1993-1998 ($p < 0.001$ using both tests). According to this measure of centralization, large municipal police organizations appear to be heeding the advice of the community policing reformers who have urged them to adopt more decentralized structures.

Formalization

Formalization is the degree to which an organization relies on and enforces formal written rules, policies, standards, and procedures (hereafter we will simply use the word "policies" to refer to the items in this list). This definition consists of two important elements. The first is codification, or the extent to which the organization has implemented formal written documents that codify its policies. The second is enforcement, or the degree to which the organization enforces its policies (Pennings, 1973). Unfortunately, longitudinal data are only available for the first of these elements: codification. Measures of codification are available in the three waves of the LEMAS survey and in the 1998 survey. Each of these four survey instruments asks respondents to check off from a list of subjects those for which their agency has a formal written policy. Only 12 items appear consistently in all four instruments, therefore our measure of formalization is an additive index indicating the presence or absence of 12 formal written policies. Descriptive statistics for formalization are presented in Table II.

Both parametric and non-parametric tests reveal that there were no statistically significant changes in formalization from 1990-1993, 1993-1997, or 1997-1998. For the whole period of 1990-1998, the results were inconclusive. The parametric test revealed a statistically significant increase in formalization ($p < 0.05$) which was rendered nonsignificant when applying the Bonferroni correction. The non-parametric tests found no significant change ($p < 0.05$). Formalization, as measured here, has not changed during the 1990s.

Administrative intensity
Administrative intensity is the size of the administrative component within the organization. All organizations can be thought of as having two components: a production component that is responsible for performing the core functions of the organization, and an administrative component that is responsible for performing support functions. In police agencies, the production component consists of patrol officers, investigators, and others having routine direct contact with the organization's clients. Those whose principal functions include support or administration (such as secretaries, filing clerks, and computer staff) form the administrative component. According to Scott (1992, p. 259), the administrative component of an organization:

> . . . is not a unitary structural element but rather, . . . a "heterogeneous category" composed of varying participants performing quite different functional roles.

Organizations with large administrative components are often considered more "bureaucratic". Indeed, although the concept of bureaucracy is problematic, administrative intensity was sometimes used in early research as an overall proxy for bureaucratization (Maguire, 2002; Scott, 1992). Woven throughout the community policing reform rhetoric is the need for police organizations to become more efficient and less bureaucratic, concentrating their employees on the streets rather than behind desks.

We measured administrative intensity using the "A/P ratio", which is the ratio of administrative to production personnel. Data were available for 1990, 1993, 1997, and 1998. Descriptive statistics for administrative intensity are presented in Table II. Both parametric and non-parametric tests reveal that there were no statistically significant changes in administrative intensity from 1990-1993 or 1993-1997. From 1997-1998, there was a significant change using both parametric ($p < 0.05$) and nonparametric ($p < 0.01$) tests. For the whole period of 1990-1998, there was also a significant decrease ($p < 0.01$), based on both parametric and nonparametric tests. The slow and consistent reductions in administrative personnel that occurred during each time period, taken together, resulted in a significant reduction in administrative intensity from 1990-1998.

Discussion and conclusion
The findings presented in this paper provide mixed news for community policing advocates. Large municipal police organizations in the USA experienced significant decreases in centralization and administrative intensity, together with significant increases in occupational differentiation (which we operationalized as civilianization). These changes are consistent with the structural reform agendas of community policing advocates.

On the other hand, the "flattening" of the police hierarchy, which was featured so prominently in reform prescriptions, did not occur. We also found that segmentation, or the number of command levels, did not change significantly from 1993-1998. In fact, height, or the social distance between the

bottom and top levels of the organization, experienced a significant increase. There was no change in formalization. Functional differentiation did not decrease. It may have even increased, but due to instrumentation problems, we were unable to draw more conclusive inferences.

The news with regard to spatial differentiation, also one of the most important elements of the community policing reform prescription, is mixed. There was a significant increase in the number of police stations, though most agencies maintained the same number of stations from 1993-1998. There was also a significant increase in the use of mini-stations, though we were unable to assess the magnitude of this change reliably due to instrumentation problems. The number of beats did not experience a significant net change from 1993-1998.

Overall, the evidence presented here provides more room for optimism among community policing reformers than previous research. Some structural elements have changed in the direction urged by reformers. Police agencies are now less centralized, employ a greater proportion of civilian employees, and have leaner administrative components. At the same time, however, depending on the measure used, they are at least as vertically and functionally differentiated as in previous years, if not more so. Their levels of formalization have not changed.

Spatially, they have more mini-stations and police stations, but their beat coverage has remained about the same. Even when the changes urged by reformers have taken place, the magnitudes are typically quite small. Some restructuring has taken place. While it cannot be characterized as a wholesale organizational transformation in the structures of American police agencies, it also cannot be discounted as a complete absence of change.

The analysis we have presented here focuses exclusively on describing changes in the core structures of police organizations. It does not seek to explain these changes (or lack thereof) either in theoretical or empirical terms. That is an ambitious task which we will pursue elsewhere. By "core" structural elements, we refer to those features which are generic across organizational type. This analysis does not seek to describe many of the changes taking place among the peripheral structural elements of police organizations, many of which are very important. These elements are unique to police organizations. Examples which have appeared in recent research include citizen review boards and police paramilitary units.

Police organizations are capable of experiencing change in many dimensions: in culture, leadership, management, programs, and operations, just to name a few. Many of these changes are not reflected in the analysis presented here. We have limited our analysis to change in the formal structures of police organizations. We have focused exclusively on seven core structural elements occupying important roles in both organizational theory and in the reform agendas of community policing advocates. There are presumably many types of organizational change occurring in policing which we have not examined here.

Like police organizations, the causal environments in which they are immersed are also changing rapidly. The proliferation of information technologies, and the massive influence of the 11 September terrorist incidents are both exerting a profound influence on police organizations. Many other environmental features are important as well. In the dynamic world of policing, the analysis we have presented here represents just one more step in building a body of knowledge about how police organizations are changing. Much more remains to be done.

Notes

1. There are theoretical reasons to support the idea that the causal order between community policing and organizational structure might be more complex or might flow in the opposite direction. This theme is beyond the scope of this paper, but it is explored in more detail elsewhere (Greene *et al.*, 1994; Maguire, 1997).

2. Langworthy (1986) operationalizes this variable as the percentage of civilians employed by the the agency. Although civilians in police organizations perform a variety of functions that are not necessarily specialized (e.g. Lutz and Morgan, 1974), they do represent a separate occupational category from sworn police officers. Absent more reliable measures, civilianization serves as a reasonable proxy.

3. In this paper, we treat each structural measure separately. We are currently exploring methods to combine multiple indicators of each structural dimension into composite measures. Those issues are well beyond the scope of this paper.

4. We have heard this term used for years, but were unable to find a citation for it.

5. In 1997, the authors of the LEMAS survey, prompted by concerns from scholars, changed the format of the question on special units. The wording of the question is similar in that it still asks respondents to indicate whether they have full-time personnel assigned to a specialized unit for each of several functions. The 1997 survey, however, provides respondents some additional options, such as having personnel available for each function as needed, but not a specialized unit with full-time personnel. These changes made it easier to determine how police agencies define a special unit. Part of this concern was based on research by Walker and Katz (1995), who discovered a substantial degree of measurement error in one of the 1993 LEMAS questions regarding specialized units. Specifically, 37.5 percent of the departments who indicated in their LEMAS responses that they had a specialized unit for enforcing bias crime statutes later reported that they never had such a unit. The measures used from the 1990 and 1993 data still suffer from the measurement error identified by Walker and Katz, but the measure from 1997 presumably does not.

6. The analysis of structural change in this paper is based on listwise comparisons, which means that only agencies which are present in all waves of the longitudinal series are included in the analysis. The target population is municipal police agencies employing 100 or more sworn officers. Since American police agencies are growing rapidly, many of the agencies falling just below the 100 officer threshold in 1993 (and therefore excluded from the earlier data sets included here) now employ 100 or more sworn officers. As a result, the number of agencies in the population has grown from 432 in 1993 to 482 in 1997. Furthermore, the composition of the population has changed as well, since the 50 new agencies in the population are all concentrated at the lower end of the agency size spectrum. Therefore, to assess accurately the degree of change in these agencies, it is important to ensure that each panel contains the same agencies within any single analysis.

7. Unless otherwise stated, these are the parametric and nonparametric tests we use throughout the study.

8. For instance, in this case there were three *t*-tests (0.05/3 = 0.0167). Therefore, any contrast in which the probability associated with the *t*-value is less than 0.0167 is considered statistically significant at the 0.05 level. Although we conduct a Bonferroni correction procedure by default in each analysis, we only discuss it when the findings are substantively useful.

9. In other work, we have discussed potential problems with using civilianization as a proxy for occupational differentiation (Maguire, 2002). Despite these problems, it remains the most reasonable measure that is available for longitudinal study.

10. There is one exception. In 1990, the sum of the employment categories did not equal the total number of employees for two agencies.

11. As Robbins (1990, p. 104) writes: "Centralization is concerned with the dispersion of authority to make decisions within the organization, not geographic dispersion."

12. Furthermore, the New York Police Department is excluded from this analysis because it added 28 stations when it merged with the Housing and Transit Police in 1996, and is therefore an influential outlier.

13. The 1997 LEMAS survey also asked a question about the number of mini-stations, but the wording of the question was markedly different from the other three surveys we examine in this section. Therefore we chose not to include it.

14. First, this measure excluded information on other kinds of patrol coverage, such as foot, bicycle, and equestrian patrols. Second, some respondents were confused by the term "night shift". Finally, very large agencies had some difficulty in compiling these numbers, since presumably they needed to be aggregated across different precincts.

15. Langworthy (1986) uses the term "hierarchical" differentiation, which is the conceptual equivalent of what we refer to here as "vertical" differentiation.

16. The concept of height is intended to measure the social distance from the bottom to the top of the hierarchy. The proxy we and others have used to measure height is based on salary differentials. Thus the concept falls within the status hierarchy, while the actual measure falls within the rewards hierarchy. This illustrates the complexity of using rough proxies to measure fine shades of meaning inherent in organizational concepts.

17. As Hodge *et al.* (1996, p. 43) write, "managers in decentralized organizations are assuming that lower-level employees have the information, knowledge, skills, and good judgment to solve problems as they encounter them."

18. Raynor and Bower (2001) view the decentralization and devolution movement of the 1990s as so strong that it has become the conventional wisdom. They recommend a strategy of managing divisions dynamically while still "leading from the center".

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